A STEP-BY-STEP, ILLUSTRATED GUIDE FROM THE EXPERTS AT MAXIMUMPC

PC HOW-TO GUIDE

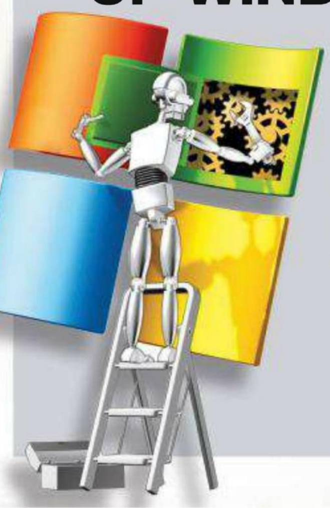
FALL 2012

NOW'S THE TIME TO UPGRADE!

REPLACE YOUR CPU AND MEMORY
You'll find our expert recommendations inside

SPEED UP YOUR BOOT TIME
We have tips and tricks you won't believe!

100 WAYS TO TUNE UP WINDOWS



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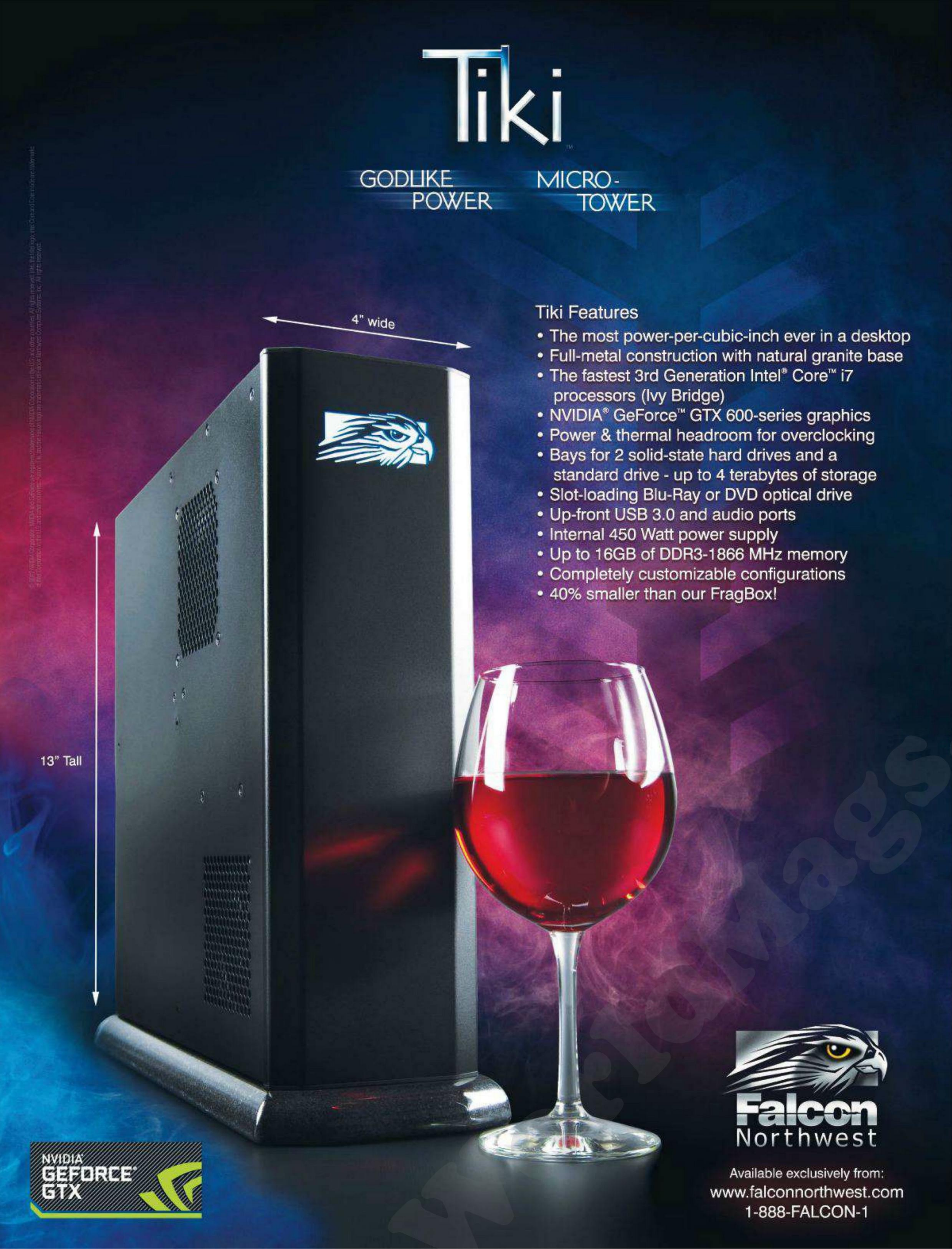
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Michael Brown

NEED HELP? WE'RE HERE TO LEND A HAND

WELCOME TO MAXIMUM PC. If you're a regular reader, you know you this special edition is jam-packed with expert how-to advice. If you're new to this magazine, take a moment to leaf through the pages and see just how much useful information we've squeezed into this issue. This isn't your average computer rag.

This special edtion is laser focused on helping you master new skills, guiding you through hands-on projects, and making sure you get the absolute maximum performance from your PC investment. Whether you're an old-hand pro or a new user just becoming acquainted with your first PC, you'll find useful, action-oriented tips, tricks, and recommenations that will make your PC life better and easier than ever before.

In our Doctor column, we answer questions sent in from readers just like you. We sometimes feel like the lead character in the TV hospital drama *House* when producing this column, because we're solving mysterious tech problems given nothing more than a few obscure clues. Check out Doctor to see if you've experienced a similar problem. Even if you don't, this column is always an entertaining read.

The next PC you buy will likely have Windows 8 preinstalled, but if you've decided to stick with your existing machine and get the most out of Windows 7, we have an in-depth feature starting on page 14 that's filled with no fewer than 100 tips on how to do just that.

"Wecome to the Virtual Machine," which starts on page 24, is an exceptionally great guide to setting up virtual machines. These virtual environments allow you to experiment with alternative operating systems, test drive new applications, evaluate new applications, and more—all without subjecting your existing PC to an iota of risk.

In the unfortunate event your PC picks up a virus or other infection in your real-world environment, "How to Rid Your PC of Malware" will guide you through the process of cleansing it, step by step.

If you're ready to upgrade your existing machine, either in preparation for a Windows 8 upgrade or just to squeeze out better performance with the OS and apps you use today, "Operation Upgrade" details how we rescued three aging PCs from the scrap heap and got them running like new.

And that's just scratching the surface of what you'll find in this issue. Happy reading!

Michael Brown is a long-time contributor to Maximum PC.

↘ submit your questions to: comments@maximumpc.com

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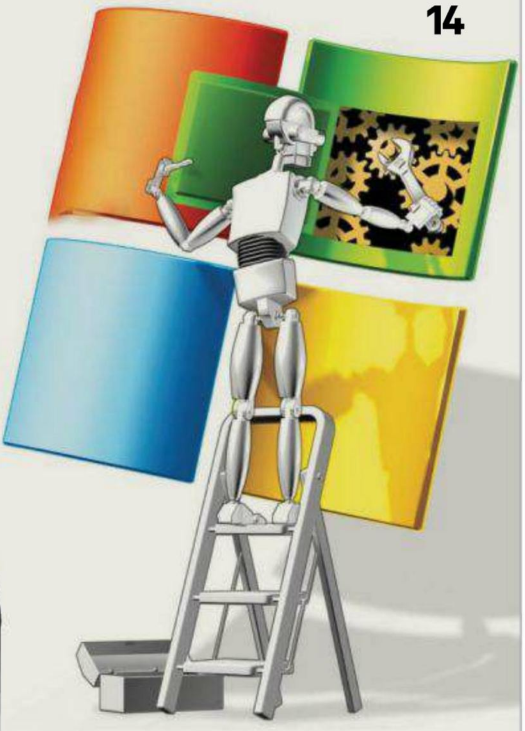

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HEAD TO HEAD

BY DAN SCHARFF

Steam vs. Origin

For years, digital distribution of PC gaming has been a one-horse race, dominated by Valve's Steam. Though other digital storefronts exist, like GOG, Impulse, and Direct2Drive, no other service has had the clout or the marketing dollars to stand up to Valve... until now. Even though as recently as several months ago we were writing off Origin as a possible Steam competitor, EA has gone all-in with its fledgling digital gaming platform. So which is better?

Round 1: Client

While common sense would dictate that Steam's well-established software be miles ahead of EA's new kid on the block, the two clients are remarkably similar. Both clients offer a storefront, community, friends list, and links to settings and options. Both clients offer customizable in-game overlays. And while gamers may quibble about which client is more resource-heavy, both clients are lightweight enough to make any minute difference between the two inconsequential to actual game performance.

Still, Steam's client has had the benefit of years of iteration to make it a more intuitive and, subjectively speaking, nicer-looking interface.

Winner: Steam

Round 2: Community/ Online Services

Comparing online communities is a dangerous proposition, fraught with rabid fanboys and volatile flame wars. So instead, we'll compare the online services and options available to the warring services.

Steam's community integration is top-notch. Inviting friends to your games is quick and painless, IM and voice chat features are robust, community pages offer what's essentially a game-centric personal blogging service, and Steam forums have practically supplanted official game forums in many cases. And let's not forget features like auto-patching, cache checking, an online screenshot library management, game recommendation system, and cloud save system.

Origin has admittedly had some growing pains in the feature department. While it's clear EA intends to eventually add more functionality, at this point the only advantage Origin has over Steam is the ability to import friends lists from other services such as Facebook, PSN, and Xbox Live.

Winner: Steam

Round 3: Stability

Though both services are fairly straightforward, easy to use, and reliable, neither is without its share of problems. Steam has long been plagued by occasional service outages and interrupted downloads, especially during high-traffic sales periods. Offline mode continues to be a bugaboo, and often fails to work at all. Still, these slight hiccups pale in comparison to EA's issues. Despite Origin's relative newness, EA has already been embroiled in scandal surrounding its controversial EULA, Origin's legal status in Germany, as well as its controversial practice of prohibiting banned forum users from accessing their Origin accounts. Throw in problems users had launching the service during Battlefield 3's launch and some early crashing issues, and Steam is affirmed as the far less flaky choice.

Winner: Steam

Round 4: New Releases

Here's where things start getting interesting. Though both services offer their share of pre-order bonuses and launch window specials, EA's Origin has actually been far more aggressive in its release window pricing. In a crowded and competitive marketplace, Origin is trying its hardest to rope in new gamers with better deals on the latest and greatest AAA titles. While Steam generally sets its new release price right about at MSRP, many new games on Origin have been discounted to $40 or less within a week of launch. Of course, this is all based on the U.S. market; if you live in Europe, you're screwed either way.

Winner: Origin

EA's Origin client has a clean and simple design... possibly due to its lack of features.

Steam isn't shy about advertising, but given the massive discounts on a huge variety of titles, most gamers aren't complaining.

Round 5: Game Library

No need to dissect this one: Steam wins. If Steam's library is the Great Library at Alexandria, Origin's is the beat-up bookmobile from your local library. Not only that; Steam's frequent bundles and sales make it a cinch to stock your digital stores with a treasure trove of backloggery. Still, we can't give EA too much guff here. For a service that as recently as several months ago was nothing but a download portal for EA-only games, Origin has made impressive steps toward expanding its selection. Steam will likely remain the archivists' choice for quite a while, but within a year or so, Origin's catalogue may be nothing to sneeze at.

Winner: Steam

And the Winner Is...

For now and the foreseeable future, **Steam**—with its impressive library of reasonably priced games, massive install base, and feature-rich client—is the platform, digital storefront, and PC gaming community of choice. But all is not lost for EA. If Origin, still technically a beta, continues to improve, it may emerge as a viable alternative to Steam. In the long term, however, the real winners might just be PC gamers, as more selection and competition in the free digital platform space spurs innovation and lower prices for all.

WorldMags

WHITE PAP

BY BILL O'BRIEN

DisplayPort 1.2

Meet HDMI's smarter brother

DisplayPort has made a few timid steps forward since its 2006 introduction; but based on what we saw at CES in January, 2012 might be the year it finally breaks through to mainstream usage.

VESA (the Video Electronics Standards Association) designed DisplayPort to be a royalty-free means of delivering digital audio and video signals from a source device to a display. As such, it was intended to allow the retirement of both DVI (the Digital Visual Interface) and VGA (Video Graphics Array), which outlived its usefulness shortly after DVI appeared on the scene. DisplayPort can be used to connect computers to desktop monitors and televisions, as well as internally (in a laptop or all-in-one computer, for instance).

DISPLAYPORT VERSIONS

The original specification supported a maximum data rate of 8.64Gb/s on a two-meter copper cable. In 2007, DisplayPort 1.1a added support for fiber-optic cable, which can carry signals more than 15 meters without developing ghosting or other signal-degradation problems. Version 1.1a also added support for the DRM systems HDCP (commonly used in consumer electronics gear) and DPCP (DisplayPort Content Protection).

DisplayPort 1.2, introduced in 2009, doubled effective bandwidth to 17.28Gb/s, rendering the standard capable of delivering higher resolutions and refresh rates, as well as increased color depth. DisplayPort 1.2 can also carry multiple independent video streams (to support multiple monitors in a daisy-chain fashion), and it supports stereoscopic 3D. This version increased auxiliary channel bandwidth to a maximum of 720Mb/s (for device management and control, including the bi-directional carriage of USB signals); expanded color spaces to include xvYCC, scRGB, and Adobe RGB 1998; and added support for Global Time Code (GTC), to enable sub-1-microsecond audio/video synchronization.

Aside from its USB capability, DisplayPort 1.2 sounds a lot like HDMI, doesn't it? Craig Wiley, chairman of the VESA board of directors, begs to differ. "Today, DisplayPort and HDMI really address two different markets. What is important to TV manufacturers isn't to PC manufacturers, and vice versa. Because of this, we do believe the two standards will coexist as external interfaces for the foreseeable future. That being said, Embedded DisplayPort and MYDP—Mobility DisplayPort, an improved version of the DisplayPort standard for mobile devices—provide additional avenues for DisplayPort to gain adoption. As devices trend toward smaller form factors and become more mobile, we see this as a major growth opportunity for us."

VESA showed several prototype Mobility DisplayPort devices at CES. MYDP is designed to simplify the process of streaming audio and video from a mobile device to a large display—without adding another port to the mobile device. It accomplishes this trick by sending high-definition video out the device's Micro USB port to a cable equipped with a USB plug on one end and a DisplayPort, HDMI, or VGA plug on the other. The new standard will also allow video conference calls by tapping into the camera on your phone or tablet.

Unfortunately, this requires a chip on the sending device that switches between DisplayPort mode and USB mode, so it won't be possible to retrofit your existing phone or tablet. No changes are required at the display end, however, and the device's battery can be charged at the same time (the DisplayPort 1.2a spec will boost power output from a current 1.5 watts to 9 watts).

HOW DISPLAYPORT WORKS

DisplayPort uses a self-clocking packet-based communications protocol, similar to what's used in Ethernet, USB, and PCI Express. This packet approach renders DisplayPort extensible; i.e., new features can be added without requiring significant changes to the physical interface. A DisplayPort connector supports one, two, or four differential data pairs (aka lanes) in a main link. Each lane has a raw bitrate of 1.62-, 2.7-, or 5.4Gb/s, clocked at 162-, 270-, or 540MHz. Data is 8b/10b encoded, meaning that every eight bits of information is encoded with a 10-bit symbol to achieve an effective (post-decoding) data rate of 1.296-, 2.16-, or 4.32Gb/s per lane (80 percent of the raw bitrate).

You might be surprised to learn that the DisplayPort spec treats both audio and video signals as optional. A DisplayPort cable might carry only audio content, only video content, or both audio and video simultaneously. DisplayPort's video signal path supports 6–16 bits per color channel, and the audio path can carry up to eight channels of uncompressed linear PCM audio encoded at resolutions of 16–24 bits and at sampling rates of 32–192kHz.

A 720Mb/s, bi-directional, half-duplex auxiliary channel on DisplayPort's main link provides device management and control. It supports communications protocols such as EDID (Extended Display Identification Data), DPMS (Display Power Management Signal-

ER

ing), and MCCS (Monitor Command Control Set) that enable a display to inform its host of its capabilities and the host to manage the display's settings and power state. Unlike HDMI, DisplayPort does not support AV.link, a low-bandwidth command-and-control protocol common in the consumer-electronics industry. AV.link enables the host to send remote-control commands to the client. HDMI uses CEC (Consumer Electronics Control) to carry AV.link data on a single wire, so DisplayPort's aux channel could conceivably be used for this same purpose.

Dual-mode DisplayPort chipsets are capable of emitting single-link HDMI and DVI signals with the connection of the appropriate passive adapter. The chipset detects the presence of the adapter and automatically switches to DVI/HDMI mode. Dual-mode ports, which are present on most DisplayPort-compatible videocards and displays, are marked with a DP++ logo. An active adapter is required to support dual-link DVI and analog component video devices (including VGA), due to DisplayPort's limited pin count.

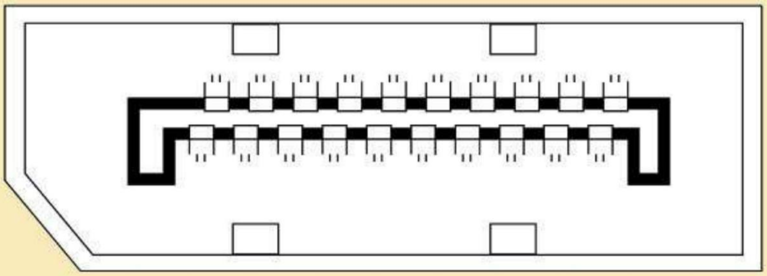
PROSPECTS

VESA hasn't delivered the long ball every time it has come up to bat, so there's no guarantee that DisplayPort 1.2 will achieve the prominence VESA is hoping for. Two things do stand in its favor: First, the demand for multiple-display technology is on the rise, thanks in large measure to gamers (especially flight-sim fans) and businesses (especially in the financial sector, where stock tickers, spreadsheets, and other analysis software all run simultaneously). DisplayPort delivers a much better multi-display solution than HDMI is currently capable of delivering.

The second factor in DisplayPort's favor is that it's not absolutely necessary to purchase a brand-new monitor in order to utilize it, thanks to the availability of DVI and VGA adapters. Bells and whistles will attract early adopters to almost any new technology, but only a solid return on investment will ensure its long-term viability. With innovative new features, backward compatibility, and reduced manufacturing costs, DisplayPort is finally showing it has legs.

DisplayPort 1.2 Pin Out

Here's what's happening behind the scenes of an external source-side connector. The spec's packet-based approach makes it possible to add new features without significantly changing the physical interface.



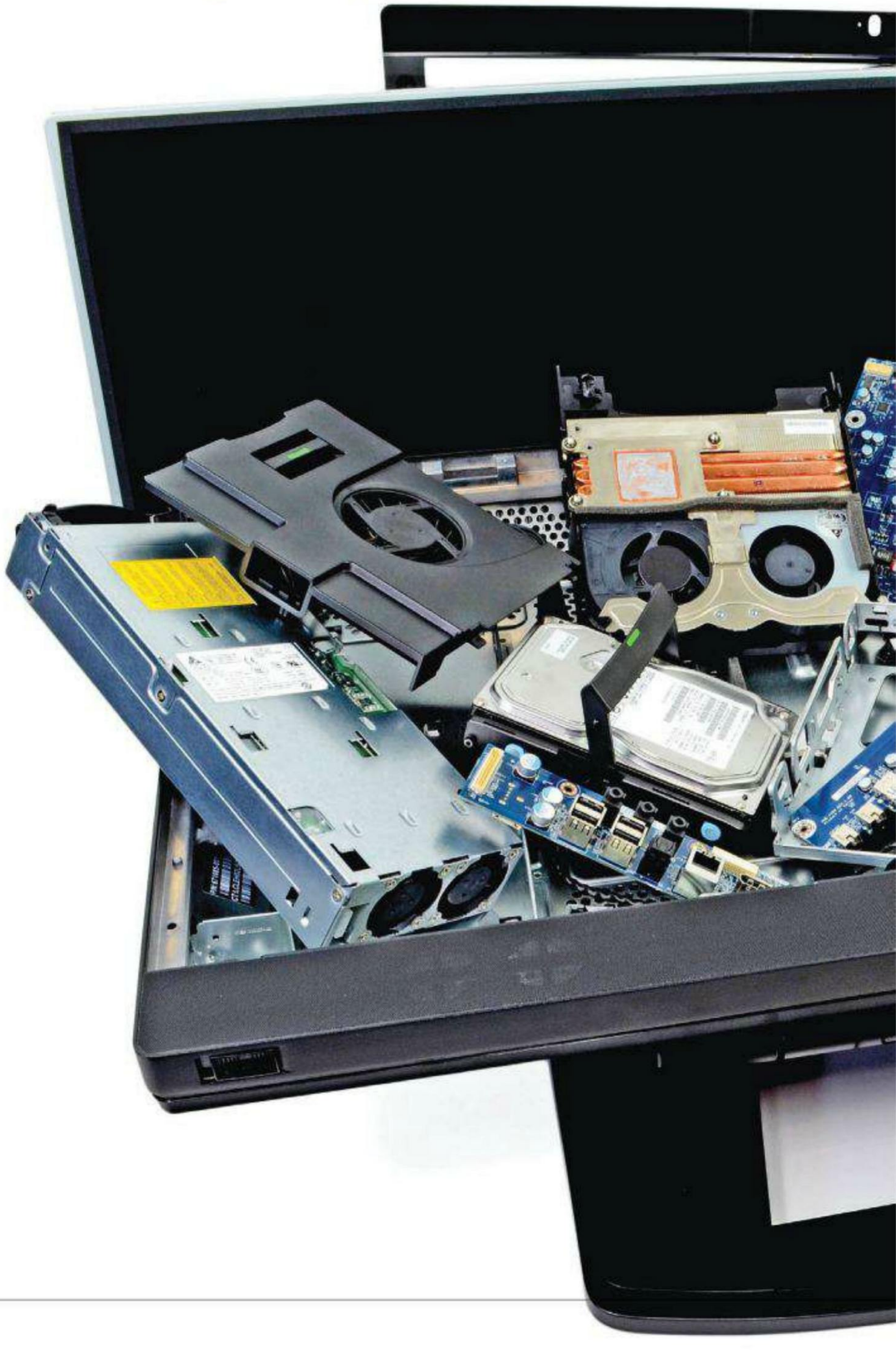
Pin 1	ML_Lane 0 (p)	Lane 0 (positive)
Pin 2	GND	Ground
Pin 3	ML_Lane 0 (n)	Lane 0 (negative)
Pin 4	ML_Lane 1 (p)	Lane 1 (positive)
Pin 5	GND	Ground
Pin 6	ML_Lane 1 (n)	Lane 0 (negative)
Pin 7	ML_Lane 2 (p)	Lane 2 (positive)
Pin 8	GND	Ground
Pin 9	ML_Lane 2 (n)	Lane 2 (negative)
Pin 10	ML_Lane 3 (p)	Lane 3 (positive)
Pin 11	GND	Ground
Pin 12	ML_Lane 3 (n)	Lane 3 (negative)
Pin 13	CONFIG1	Connected to Ground
Pin 14	CONFIG2	Connected to Ground
Pin 15	AUX CH (p)	Auxiliary Channel (positive)
Pin 16	GND	Ground
Pin 17	AUX CH (p)	Auxiliary Channel (negative)
Pin 18	Hot Plug	Hot Plug Defect
Pin 19	Return	Return for Power
Pin 20	DP_PWR	Power for Connector (3.3 V 500 mA)

iFixit presents:

AUTOPSY

THIS TIME WE DISSECT...

HP's Z1 All-in-One PC



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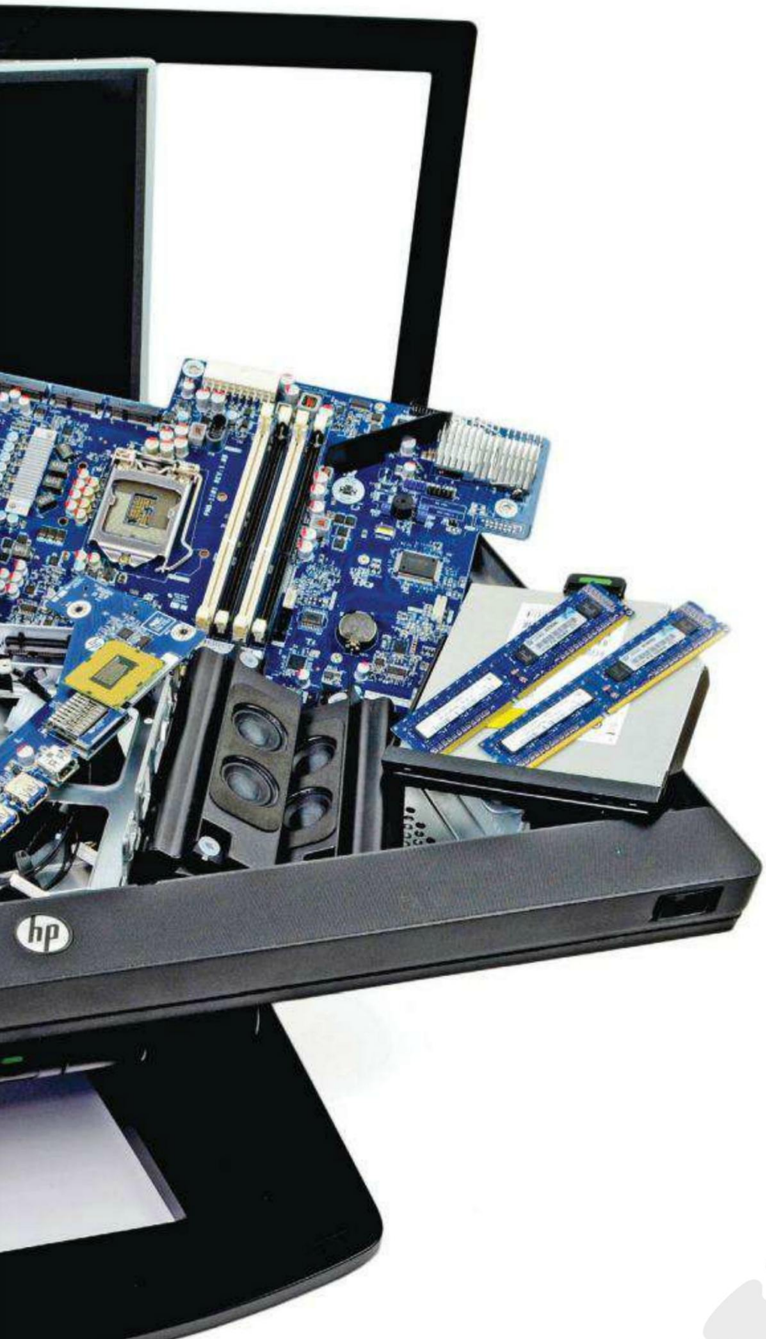


MAJOR TECH SPECS:

- Intel Core i3-2120 dual-core processor
- Intel HD Graphics 2000
- 4GB DDR3 RAM DDR3/1600
- SATA 7,200rpm, 500GB hard drive
- SATA SuperMulti DVD burner
- 400W power supply
- 27-inch, 2560x1440 pixel, LED-backlit IPS display

KEY FINDINGS:

• HP's new Z1 all-in-one workstation holds the honor of receiving iFixit's first ever 10 out of 10 repairability score! It's the most repairable PC we've ever had the pleasure of taking apart. Opening the machine is as easy as opening a briefcase, and all the major components—RAM, hard drive, optical drive, etc.—snap in and out. There's even a diagram inside the device that shows the location of the most easily replaceable components. You could probably replace the hard drive in five minutes and have time left over to sip a coffee.

• The stand folds flat beneath the workstation, which makes for easy repair access. It raises back up with the push of a green button, which we mistook originally for a power button (which is located on the top-right side).

• The hard drive, optical drive, power supply, main fan, RAM, and graphics card are attached without screws, and are simply disconnected and removed.

• The Intel processor can be detached from the motherboard with the flip of a lever.

• Non-modular components inside (speakers, motherboard, daughterboards, etc.) are held intact by T15 or T6 Torx screws, or by plastic fasteners. No glue or other funny business is used inside, aside from a taped-down thermal sensor.

• The glass and LCD are the hardest to replace, but not supremely difficult—just a bit bulky to move around. They're not fused together, and are instead held in place by those wonderful T15 Torx screws. The most difficult repair in this machine—replacing the LCD or glass—should take under an hour to complete.

• One small detriment to all this repairability? The price. The cheapest Z1 is just short of $2,000, which is a lot of dough to spend on a machine of this capability. HP's other, less-easy-to-fix all-in-one offerings retail in the $1,200 neighborhood for a similarly outfitted machine.

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

>SSDs in RAID 1
>POST Depression
>SSD/HDD Voltages

SSDs in RAID 1

Here's a question that puzzles me and others in several forums. As you know, SSDs wear out over time and fail when they reach their write or read thresholds. If you were to take two identical SSDs and set them up in RAID 1 (mirror), then theoretically they will be read and written to at the same rate. Therefore, they will also fail at the same time.

So, is it worth it to use identical SSDs in RAID1? Do you lose the level of protection that a RAID 1 provides—which is that one drive will likely fail at a different time than the other?

Can you put this theory to the test? Take two brand-new identical SSDs and create a RAID1 set. Run intensive disk read and write operations nonstop, 24/7. Let's see if both fail at the same time.

—Nicholas Nicolaou

THE DOCTOR RESPONDS: The idea that two identical SSDs in RAID 1 (and therefore given the same exact inputs and outputs) will burn through their write cycles at the same time makes logical sense. Each NAND cell does have a limited number of write cycles—around 10,000 in the case of an MLC SSD. Modern SSDs use wear-leveling algorithms and overprovisioning to ensure that the cells all run through their write cycles at around the same rate. Once a cell has run through its write cycles, it doesn't "fail," per se, it just becomes read-only, so you should still be able to access the data on the drive.

RAID 1 makes some sense for mechanical drives, which have moving parts and thus higher failure rates than SSDs, and when they fail, you usually can't read or write to them. As a home user, you're not likely to run through your SSD's write cycles during its operational lifespan, and in any case, you should still be able to retrieve your data from the drive, even if all its cells "wear out." SSDs can fail in ways that don't involve running through their write cycles, so RAID 1 could still make sense if you're really paranoid, but if you're just worried about your drives "wearing out" due to write cycles, the Doc thinks it makes more sense to make regular backups on a mechanical drive instead, and avoid spending money on a superfluous SSD.

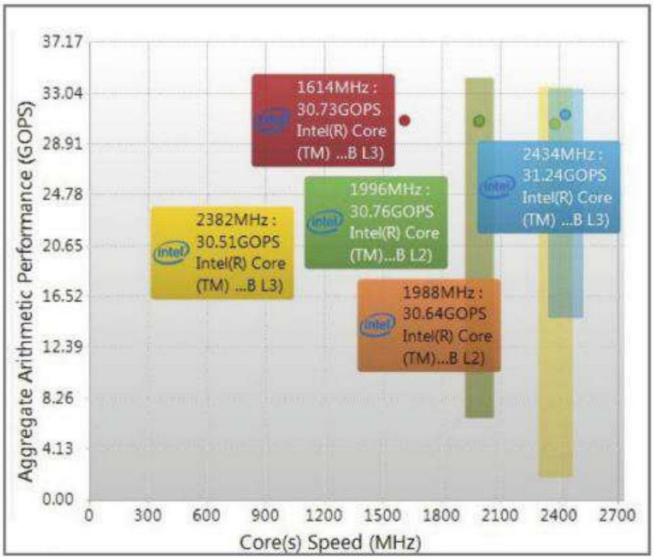
Super Instability

I built a brand-new system I call The Supercomputer. It has a Core i7-3930K, G. Skill Ripjawz-series quad-channel memory (32GB), dual Radeon HD 6950s, two Western Digital 2TB and two 1.5TB, Windows 7 ultimate 64-bit, a Blu-ray player, and an Asus Rampage IV Extreme motherboard. I am a huge gamer, and occasionally the system crashes on either Modern Warfare 3 or Skyrim. When it crashes, the whole computer freezes. I am very lost. I think it's the motherboard, but I'm not sure. What do you think?

—Jake Provenzano

THE DOCTOR RESPONDS: That is indeed a very sweet rig, but hard locks aren't good. Assuming you are overclocking, stop overclocking or back it down to a level that's more stable. Your crashing could come from many areas. The cheapest thing to check is your CPU cooler. Ensure that it is correctly installed, and that you didn't use too much or too little thermal paste. It's also common to neglect to install the cooler, so the chip may be overheating.

Download and run the memory diagnostic tool Memtest86+ from Memtest.org. Hopefully it works, as it's been updated for Sandy Bridge chips, but not Sandy Bridge-E. The Doc also notes that motherboards using the quick-release slots for RAM make it very easy not to fully



SiSoftware's popular Sandra 2012 utility includes many analysis, benchmarking, and diagnostic tools. A five-client Professional Home version runs $50.

submit your questions to: doctor@maximumpc.com

insert the RAM in the slot. That can make the system unstable and can also lower performance. Check this by looking at the amount of RAM that Windows is reporting. Also download SiSoft Sandra from SiSoftware.net and run the memory bandwidth test. You should see from 35GB/s to 40GB/s of bandwidth, depending on what your RAM is set for. You also didn't say what kind of PSU you have, but low-quality power supplies are often at the root of problems on DIY systems. The Doc would probably also remove one of the GPUs from your system in the meantime until it stabilizes.

POST Haste

I have built my first computer using a lot of your recommendations. After running well for about a month, the PC has failed to POST. Do you have recommendations on testing tools to help find the real issue? Perhaps you could recommend the basics, as well as what would be good for those who don't mind spending extra dollars to get more advanced equipment.

—Mike Newcomb

THE DOCTOR RESPONDS: You didn't mention your configuration or if you were overclocking, but here are a few general tips to follow when your machine won't POST or turn on at all. Check the power cable that plugs into your PSU; it may have wiggled loose if you didn't insert it far enough initially. Check your power supply switch's on/off button, check the socket that the PC is plugged into to see if it's hot. If it's in a power strip, check the power switch to see if it has been turned off or tripped. Open your case and double-check the Main Power Connector that plugs in near the RAM, and the ATX12V/EPS12V connector (that 2x8 connector that plugs in near the CPU). The Doctor would also check the power switch on your PC. This may have backed off when you tinkered in the box or the actual switch may have failed. If your board has a power button mounted on the PCB, see if pressing that will fire it up. Obviously, if it works with this switch but not the switch on the PC, the latter switch might be bad.

If all of the connections are good, it's time to reset the CMOS on the board. There's usually a button or a pair of jumpers that will let you do this. If that doesn't do the trick, the most likely culprit is the PSU, if it's a lower-end model. Try to borrow or use a secondary PSU to see if the machine fires up. From there, consider reseating the motherboard and CPU.

Use Thy SSD

After a new install of Windows 7 on a 256GB SSD, what folders should be moved to the hard drive in order to keep the SSD read and write cycles to a minimum? I've searched the Internet and found bits and pieces of what should and shouldn't be moved, but I never found a complete list. I also found disagreement on whether or not a certain folder should or shouldn't be moved. After a few weeks of searching, I'm more confused than ever.

—Mike Kipper

THE DOCTOR RESPONDS: A 256GB drive is big enough that you don't need to be a miser with your space, as long as your documents aren't on it. The Doctor recommends setting your Libraries so that they default to folders on the mechanical drive, but leaving everything else as is. You could also use Steam Mover to keep only the games you're playing at the moment on your SSD and the rest on your mechanical.

You also shouldn't really worry about minimizing read and write cycles—you bought an SSD, so use it! It's the write cycles you need to worry about, anyway, and you're incredibly unlikely to run through all yours before you upgrade to a larger SSD. SSDs are useful because they're fast, and you won't get any benefit from that speed boost if you try not to use your SSD for anything.

Wireless Audio

I'm in the process of building an entertainment PC and would like to connect wirelessly to my stereo amp so that I can play music and TV sound through my main speakers. I have not been able to discover a transmit-and-receive system that can do this. Any recommendations?

—Charles Cobb

THE DOCTOR RESPONDS: Not knowing your particular setup, if all you're looking to do is stream stereo audio from your PC to your stereo without wires, Aperion Audio's Zona Home Audio Link ($150, www.aperionaudio.com)can connect to your PC's USB port and stream audio to a companion receiver plugged into your stereo system. If your PC has a TV tuner, it could stream TV audio to your stereo, too (although you'd still need a cable to send video to your TV). Multichannel audio is a whole different diagnosis. However, if you want to stream both audio and video to a receiver wirelessly, and all your equipment is outfitted with HDMI, a wireless HDMI device such as the Rocketfish WirelessHD ($600) kit will do the trick.

SSD/HDD Voltages

I've noticed that after using my notebook and tablet for the last year, my need for a large desktop PC is greatly reduced. So I've decide I'd like to build a home network of mini-boxes.

I'd like to use a combination of SSDs and notebook hard drives. However, I'm not sure if the voltages needed to run both SSDs and mini HDDs are available on low-wattage PSUs. I've looked at different online PC dealers, but not enough specs are listed. Am I looking to do the impossible?

—Lauren More

THE DOCTOR RESPONDS: That's not impossible at all. SSDs and notebook hard drives use the same 5V SATA power connectors as desktop hard drives, and indeed consume less power. You should be able to use them in any small form factor PC, though you may need to buy a 3.5-inch-to-2.5-inch drive bay converter if the chassis is a few years old.

SSD Install Fail

I have tried, unsuccessfully, to install an 80GB Intel X-25 SSD into my Asus G73 laptop using the recovery discs. I have used the recovery discs prior to this SSD install attempt with the original HDD to remove a bad file (virus), and it worked just fine. When I install the SSD using a Windows 7 Ultimate 64-bit disc it works fine, but I like the drivers and features on the original image. When I try the backup discs with the SSD, it looks like everything is working fine, with the HDD activity light blinking, but after five DVDs and an hour of time to see if it has taken, all I get after rebooting is an error message: "No operating system found." I have reformatted the SSD with an NFTS filesystem prior to installing the SSD into the laptop, but the result is the same.

In frustration I installed it into my MacBook, and it works fine with Snow Leopard, but I really want to increase the performance of my Asus. I do not know why the recovery discs are not installing.

—John Neal

THE DOCTOR RESPONDS: John, the disc imaging process is likely failing because it's trying to replicate the original partition, which was sized for a 500GB (or larger) mechanical hard drive, onto an SSD that's much too small. You'll have to do a clean install, but you should be able to download the drivers and features you want from Asus's support website (support.asus.com).

One Card, Three Monitors

I'm looking for a graphics card to run three monitors side by side. I'm a systems administrator. I don't play video games (I pretty much suck at 'em). I occasionally edit pics, run virtual machines, and frequently use over 50 percent of my RAM. I'm using a Dell Studio XPS with 12GB of DDR3, WD Raptors in RAID 0, a Silent Pro 800W PSU, and an Intel Core i7-975 Extreme.

I decided to add a third monitor, since I usually have a lot of windows open. I'm looking for a card that will increase my system performance instead of slowing it down. I tried using an Asus HD 6670. That was a fail. It made every single click slower. My computer runs like crap with this card and three monitors. That's what I get for trying to go cheap. What's the Best of the Best for this situation? If possible, I would like to keep it under $300.

—Steve Culpepper

THE DOCTOR RESPONDS: At that price range, we would go for an AMD Radeon HD 7850. It will support up to six monitors with AMD Eyefinity (although for that configuration, you'll need to use DisplayPort daisychaining). It's the best card you can get for under $300 that supports three monitors, unless you can find a Radeon HD 7870 on sale.

Core i7 Slowdown?

Doctor, I need help with my PC! It is running at 1.6GHz when it's supposed to be running at 3.4GHz. My CPU is a factory-overclocked Core i7-2600K. I've tried to fix it through my BIOS, but that didn't work. Help!

—Geva

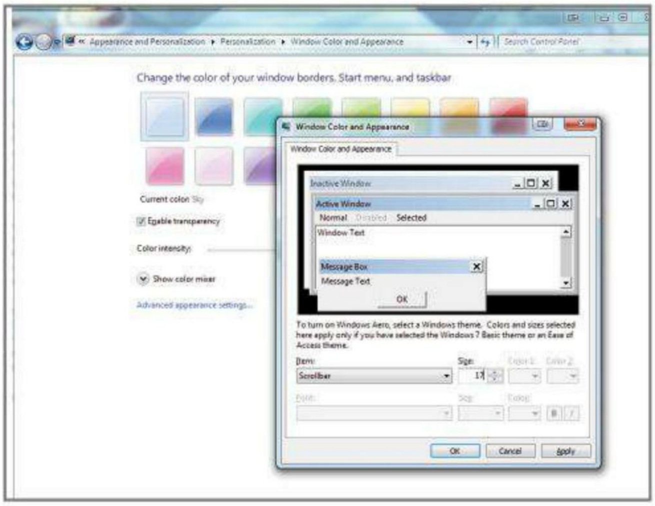
THE DOCTOR RESPONDS: Your CPU is designed to run at a lower clock speed when it's not being used. Download TMonitor from CPUID.com and run it. If you're not doing anything else with your computer, you should see that the clock speed is around 1.6GHz. But if you do something that actually utilizes the CPU (like run Prime95 or another benchmark), you'll see the clock speed go up to 3.4GHz on as many cores as you're using.

Relief for Sore Eyes

In Windows Vista and previous versions, I have always been able to adjust the width of the scroll bars. Many of the people I provide tech support to are baby boomers and they have a hard time using the scroll bars on the default setting. I used to be able to go through Display Options and set them manually to about 22 pixels. I would also adjust the size of the font up to 12 or 14 on the desktop icons and sometimes the icons themselves up as much as 44 pixels. I do this for them so they don't lose the resolution for watching movies and other media by changing the entire screen resolution. But now with Windows 7 I swear I just cannot find any way to do it. If I knew where to look in the Registry I would go in and change the default so users could not knock it out of whack if they go on an exploring expedition.

—Carl Smith

THE DOCTOR RESPONDS: Microsoft buried this option in Windows 7, but it's still there. Right-click the desktop and select Personalize, then Window Color, then hit Advanced Appearance Settings. This will open the Window Color and Appearance dialog. Under the Item drop-down menu, scroll to Scrollbar. You can then adjust the width of the scroll bar in pixels (the default is 17).
To change the text size, go to Control Panel > Appearance and Personalization, and under Display select "Make text and other items larger or smaller." This will give you basic small/medium/large controls; to fine-tune settings, look in the left-hand menu for "Set custom text size (DPI)."



You can adjust the size of many Windows features in the Windows Color and Experience dialog.

SSD Alignment

Back in November 2011 I purchased a 64GB Crucial M4 SSD so I could use it as cache for my hard drive via Intel's Smart Response Technology. I took the SSD out of the box, updated the firmware and set it up through the Intel Rapid Storage Technology interface, and have been running with it ever since. I was wondering if I needed to have formatted/aligned the SSD before using it for caching? Have I been cutting my SSD's lifespan by not formatting/aligning it? Is formatting/aligning only particular to using it as a regular storage device or boot drive? There have been no problems with IRST. I have seen improvements in program response as well as faster boots and shutdowns.

—Joeseth Perez

THE DOCTOR RESPONDS: If you're just using it for caching, IRST (which handles SRT—why did Intel use such similar initialisms?) should handle all that stuff for you. Aligning is only an issue if you're using Windows XP, as Vista and 7 automatically align SSDs correctly, and if you're just using the drive for caching you don't need to worry about formatting, as SRT takes care of all that.

Upgrade, Then Sell?

I'm planning on building a new computer. My current computer has a liquid-cooled 3.2GHz quad-core Phenom, an Asus M4A88TD-M motherboard, a 1GB Radeon HD 5770 videocard, 16GB DDR3/1333, and a 1.5TB hard drive. Should I put in a new CPU (such as an FX-8150) and overclock that and the RAM before I sell it, or just sell as-is?

With the money, I plan on building a new PC with a Core i7-3820, a 3GB Radeon HD 7970 Black Edition, 32GB DDR3, a 256GB Samsung SSD, and an Asus Rampage Extreme motherboard. Or should I wait for Ivy Bridge-E to come out?

—Cody

THE DOCTOR RESPONDS: There's no point in spending money on a new CPU for a computer you're trying to sell. Let whomever buys it upgrade it if they want. PC hardware will always be faster and cheaper later. To help you make your decision though, a Sandy Bridge-E Core i7-3820 is a serious step over a Phenom II in compute-intensive tasks, so it will feel noticeably different. Rumors point to Ivy Bridge-E not making an appearance until early next year.

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WorldMags

By Gordon Mah Ung and Nathan Edwards

100 WAYS TO SPEED UP WINDOWS

YOUR TIME IS PRECIOUS. THAT'S WHY WE HATE TO SEE WINDOWS CONSUME MORE OF IT THAN NECESSARY. WHETHER YOUR OS HAS BECOME INCREASINGLY SLOW, OR YOU JUST SPEND TOO MUCH TIME DOING SIMPLE TASKS, THE FOLLOWING 100 TIPS AND TRICKS WILL GIVE YOUR PRODUCTIVITY A WELCOME KICK IN THE PANTS. BY JAMES STABLES

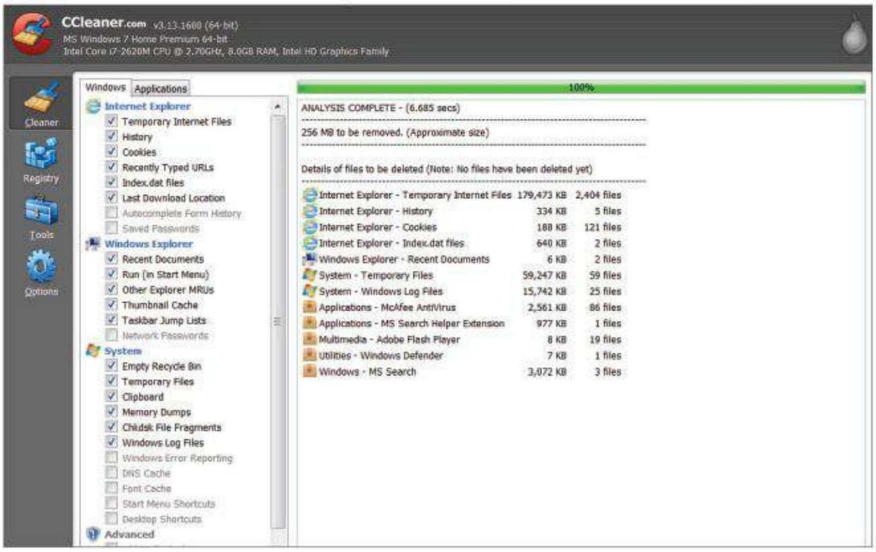
1 TRIM YOUR START-UP

One of the biggest causes of a PC slowing down over time is too many programs competing to start when the machine boots. For PC users, every step is plagued by people peddling their wares, regardless of the impact on the user experience, from manufacturers preloading trialware and bloated software to legitimate software makers who honestly believe their program should open as soon as your computer starts. The result is chaos and can slow your PC to a crawl, but fortunately, it's easy to trim things back.

In Windows 7 you can use Windows Defender to help stay on top of programs. Just go to the Start menu, type **msconfig**, and open the console. At the top you'll see a tab called Startup. Click it and you'll see all the programs that are scheduled to start when Windows does.

A lot of these are services for your PC, and eliminating them from startup doesn't always mean smoother running. For example, many PCs will have the HD Audio software start up automatically, which is pretty essential. However, as you scroll down the list, you'll start to see regular offenders.

If you've been suffering a slow boot, you'll know which programs are the most bloated, so uncheck these before pressing Apply. If you don't recognize a program, or its location doesn't show it to be in the Program Files, we recommend you just ignore it altogether.



2 CLEAN UP YOUR HARD DRIVE

Over time your PC will become clogged with unwanted files, and this will cause it to get slower. Just like a race car that's full of unwanted junk, clearing out the rubbish will make a huge difference.

The first thing you can do is go to Start > Accessories > System Tools and go to Disk Cleanup. This checks your PC for unwanted temporary files, which are left behind after programs are installed, as well as your Recycle Bin and other common clutter bugs. It will give an estimate of how much waste you can eliminate. Just click OK to begin the cleanup.

If your PC is really full, you might need a more powerful clutter cutter. CCleaner is a heavy-duty software uninstaller that goes a lot deeper than the system tools. It's available (for free!) at www.piriform.com. Install the program and enable the option to smartly detect cookies to keep. When the program opens, click the Analyze button to see how much clutter is present—you might be in for a surprise.

When you're ready, just click Run Cleaner and watch as CCleaner trims the fat from your computer, leaving it leaner and faster. Run the program every month and your PC will be less susceptible to slowing down over time. There are other free programs that can declutter your system. We've listed five that we like on page 28. They can make a real difference in the speed of your PC.

3 STREAMLINE YOUR PC

PCs take a lot of abuse, and folks who like to try new software will often leave lots of unwanted applications on their PCs. Removing these is a quick, easy fix that will speed up your PC.

To begin, click Start > Control Panel, then select Uninstall a Program. If you have Windows Vista or Windows 7, then right-click the Name column header, click More, and choose the details you'd like to see about each program. We recommend checking the Name, Size, Installed On, and Last Used On boxes.

Now choose to sort by Date Last Used, and you'll see your applications sorted by when they were last run.

If you have programs that haven't been used in months, then try getting rid of them, or switching to a free download that can be installed when and where you need it. Many programs are now available in the cloud. This means that there's next to no footprint on your PC, and the bulk of storage is contained online. There are cloud versions of Photoshop, Office Word, Excel, and OneNote, which offer stripped-down functionality.

You can also click "Turn Windows features on or off" or "Add/ Remove Windows Computers" to remove Windows applets you're not using, but this generally has less effect. If you never run an applet then it won't slow you down and turning a feature off won't free up much, if any, disk space, either.

4 SAVE TIME WITH AUTOHOTKEY

1 Install AutoHotKey

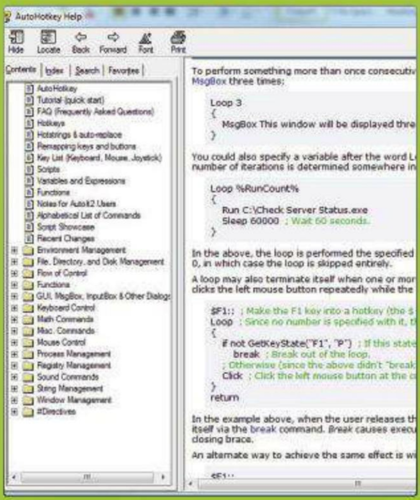
AutoHotKey (free, **www.autohotkey.com**) is a powerful tool for automating repetitive tasks. Download and install it, then right-click your Desktop or inside any folder and select New > AutoHotKey script. Right-click the resulting .ahk file to edit it. Hope you like plaintext!

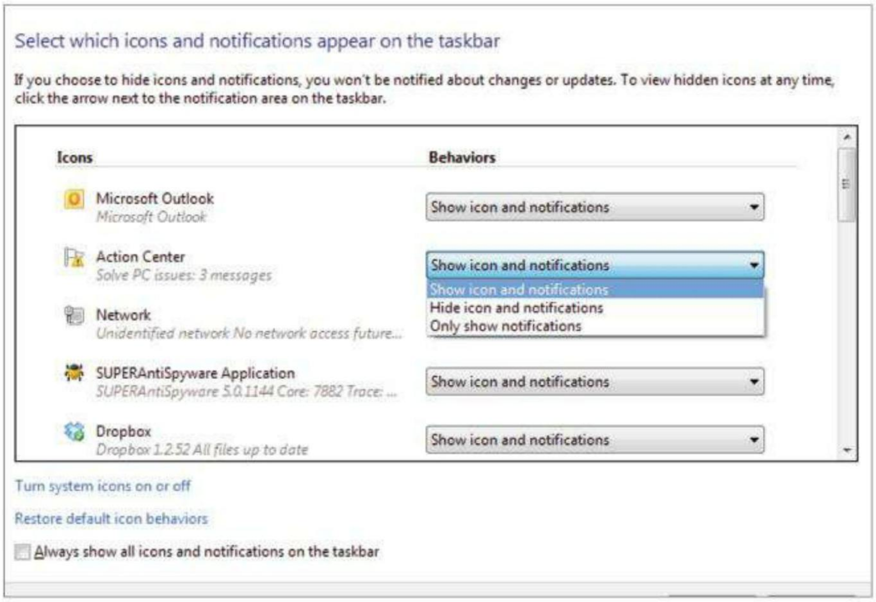
2 Read the Manual

AutoHotKey lets you create keyboard shortcuts, text expansion snippets, and macros, but it has a steep learning curve—fortunately a robust tutorial takes you from **#space::run www.maximumpc.com** (which sets Win + Space to launch MaximumPC.com in a browser window) to complex conditionals and macro recording.

3 Get Ambitious

AutoHotKey's scripting language is powerful—you can use text expansion to save you typing time, or do something as complex as using one button to screencap, import to Photoshop, crop, and save. It may take a while to script, but the results will save you lots of time. Check out *Maximum PC*'s 2010 How To for more! **bit.ly/LKgU1d**





TASKBAR SPEED-UP TIPS

When it comes to saving time, the taskbar is a very powerful tool

8 LAUNCH APPS FAST

To select a taskbar app from the keyboard, hold the Windows key and press one of the numbers across the top of your keyboard. Press 1 to launch the first icon, 2 for the second, 3 for the third, and so on up to 0 (that represents 10), so you can have items open in seconds.

9 FAST TASK-SWITCHING

To quickly switch between windows of the same application, hold down the Ctrl key as you click the app's taskbar icon. This is great for when you have multiple instances of Internet Explorer with different websites, or when you're working with photos and images.

10 KEYBOARD SPEEDUP #2

To switch to a taskbar application from the keyboard, hold down the Windows key and press T to select the taskbar, then use the left and right arrows to select an application and the Return key to launch it. This can be easier than remembering numbers.

11 RELAUNCH WITH A CLICK

If you've launched an application and then want to run another copy, don't go back to the Start menu—just hold down Shift, click the app's taskbar icon and Windows fires up another instance of the program. Again, this works especially well for browsing.

12 GET A PREVIEW

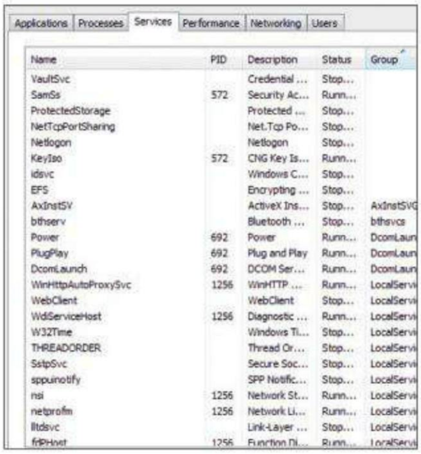
If you work with multiple windows, such as several tabs in IE, finding them can be a drag. In Windows 7, just click the program icon on the taskbar to get live preview windows of every tab or window. This makes it easy to go straight to where you need to be.

5 MANAGE YOUR SERVICES

Services are programs designed to work silently in the background on behalf of both Windows and some third-party applications. They're loaded before the Welcome screen appears and run regardless of which user is logged on.

Services cover a wide range of uses and, depending on your computer, not all will be needed. For example, the Windows Update service is essential because it monitors and downloads updates for Windows, but the Bluetooth Support service is only relevant if you have a Bluetooth adaptor installed in your PC.

Having these services running can be a real drain on your PC's performance, but with some nifty tools you can get them under control. One such tool is SMART (bit.ly/dosSJj), which takes a lot of the risk out of canceling services by telling you which ones are safe to stop.



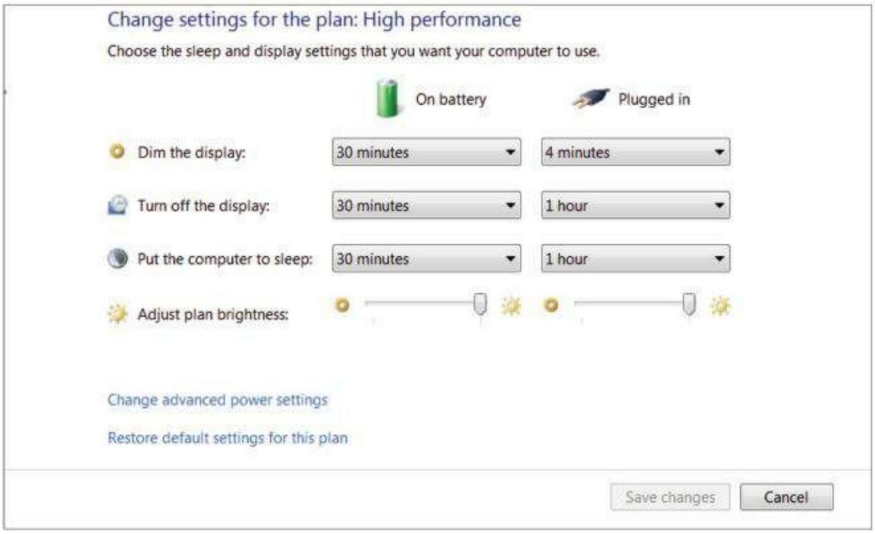
6 TAKE CONTROL OF YOUR SYSTEM TRAY

Perhaps you've wondered about that odd assortment of icons that lives at the far right of your taskbar, in the area commonly known as the system tray or notification area. It's a visual cue of what programs are running in the background, with the notifications letting you know about changes or updates to a program. You can take full control of the system tray so that it contains the information that's most useful to you, thus increasing your efficiency.

To customize the system tray, right-click the taskbar, select Properties, and then click the Customize button in the middle of the screen. Now, for each program decide how and when you want the icon and notifications to be displayed. You can also rearrange which icons appear on the taskbar itself and which ones are only visible when you click the system tray arrow. Just drag and drop to your liking.

7 ENABLE PREVIEW PANE

You can save a lot of time by enabling the preview pane in Windows Explorer. It lets you see the contents of any file without having to actually open the file. Open Windows Explorer (explorer.exe), select Organize, and then Layout. Select Preview pane from the menu. Now, when you click on any file in Explorer you will instantly see its contents in the preview area to the right. You can adjust the size of the preview area by dragging its left-hand border.



13 HALT RUNAWAY PROGRAMS

If a buggy program is grabbing all your processor time, slowing everything else down, and you can't close it, press Ctrl + Shift + Esc to launch Task Manager. Click Processes, then select "Show processes from all users." Click the CPU column header and find the program using the most CPU time. Right-click the program, select Set Affinity, clear all but one of your processor core boxes to limit how much of your system resources it can use. Your PC will speed up.

14 CUSTOMIZE THE POWER BUTTON

If you find that you typically restart your PC more often than you shut down, you can save yourself the cumulative nanoseconds incurred every time you have to select Restart by making that the default button option. Right-click Start, choose Properties, and under the Start Menu tab, select the power button action that you use most frequently.

15 VISUALIZE YOUR STORAGE SITUATION

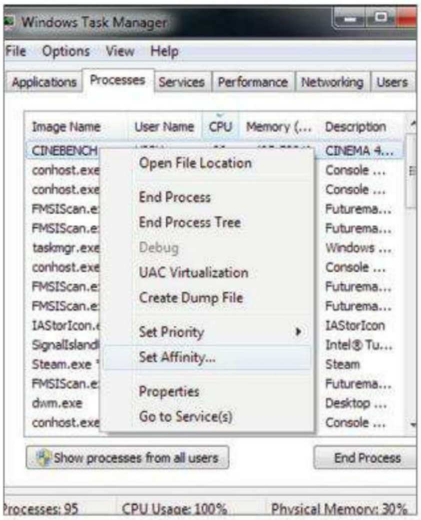
There's no better way to see what you're storing on your hard drive and whether it's earning its keep than by using a visualizer. One of our favorites is WinDirStat (free, www.windirstat.info). On startup it creates a rectangular treemap of all your folders and files, color-coded by file type. With the graphical evidence before you, you can easily determine what stays and what goes.

16 USE HIGH-PERFORMANCE MODE

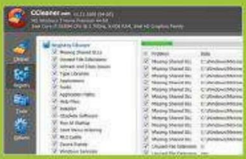
The Windows 7 Power Options can make a real difference to system speed. Go to Control Panel > Hardware and Sound > Power Options, and ensure you have High Performance selected. Alternatively, if your computer is being too demanding on your laptop's battery, then you can go into a low power mode, but this will slow Windows down.

17 SET YOUR PC TO BOOT WITH GREATER SPEED

If you've installed multiple versions of Windows on your computer, you'll get a menu asking which version you'd like to launch. By default this waits up to 30 seconds before selecting the default choice, but if that's too long, launch msconfig from the Start menu, click the Boot tab, and set the Timeout figure to, say, 10 seconds instead.



FIVE PROGRAMS FOR KEEPING YOUR PC SPEEDY

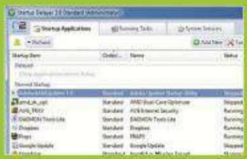


18 CCleaner

We mentioned the awesome cleaning power of CCleaner (see tip #2), but it has other powers, too. Try using the Registry Cleaner, which spring cleans the back end of Windows for faster performance. bit.ly/8XAvD9

19 Glary Utilities

Another piece of cleaning software that gets rid of leftover files, Glary can also securely uninstall programs, which is a notoriously messy experience when done in Windows. www.glarysoft.com



20 Startup Delayer

This free program will stagger your startup apps, which stops Windows from grinding to a halt. To learn more about how to put Startup Delayer to use, see our How To on page 56. www.r2.com.au

21 Foxit Reader

If you regularly read PDFs, you probably get frustrated by Adobe Reader's lumbering lack of speed. Foxit Reader speeds things up, making viewing PDFs quick and easy. It also uses very little of your computer's memory. bit.ly/KvjPZb

22 Everything

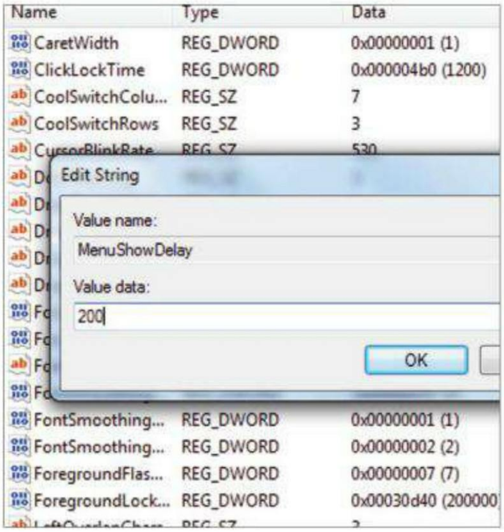
Windows' native search functionality has improved greatly over the years, but if you want a truly speedy search of your PC's contents, you need the free file-indexing app Everything. www.voidtools.com

23 DELETE DUPLICATE MUSIC IN ITUNES

It's an unfortunate fact about iTunes on Windows that it will sometimes store duplicate tracks of the same song.

Luckily, iTunes includes a tool that finds, identifies, and removes duplicates, keeping your music collection trim and, more importantly, your computer lean.

In iTunes, go to File > Display Exact Duplicates and a list of all repeated songs will be displayed. It would be a lot easier if iTunes only showed the duplicate ones, but unfortunately it displays both, so you'll have to tick the second version and hit Delete.

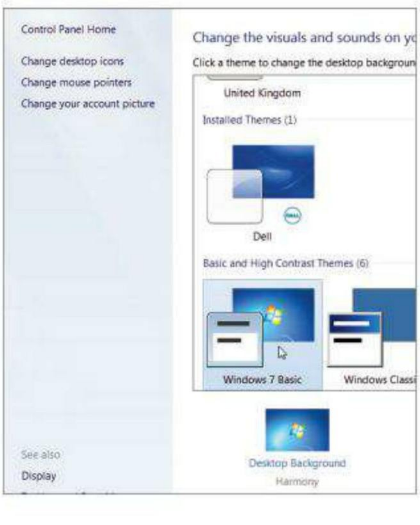


24 REMOVE OLD PICTURES

When you edit a photograph in Windows Live Photo Gallery, it keeps a copy of the original forever. That's great if you've actually made the new pic look awful or want to keep the original, but otherwise it's a waste of space. To tweak this, launch Photo Gallery, click File > Options > Originals, and under "Move originals to Recycle Bin after" select one month—or longer if you prefer.

25 SAVE RESOURCES

If you've installed an antivirus package, it's a waste of resources to have Windows Defender running as well, since you essentially have two programs doing the same tasks. To turn off Defender, click Start, type **Defender** and click Windows Defender to fire up the program. Click Tools > Options > Administrator, clear the Use This Program box, and then click Save.



26 SPOT HIDDEN WINDOWS

Sometimes programs display a message asking you to do something, but that message is under another window and you don't see it. You're waiting for the program, it's waiting for you, so nothing happens. The window is made visible after 200 seconds, but you can shorten the delay. Launch regedit from the Start menu, go to HKEY_CURRENT_USER\Control Panel\Desktop, double-click ForegroundLockTimeout and select Decimal. Change the value to 30,000 milliseconds (30 seconds) and see how this works.

27 SAVE A REGISTRY KEY

Sometimes a change to a registry key doesn't go as planned. It's quick and easy to return to the key you changed if you've saved it to Regedit's Favorites menu. It's at the top of Regedit's editing window. Click Add to Favorites, give it a descriptive name, and tweak away knowing that changes can be undone in seconds.

28 DISABLE AERO

If you're running Windows 7 on an underpowered computer, improve performance a little by turning off the Aero interface. Right-click an empty part of the desktop, select Personalize, scroll to Basic and High Contrast Themes and click Windows 7 Basic. If you miss the old look, return to the Personalize dialog and choose an Aero Theme.

Alternately, you can disable Aero for just a particular program—say, something that could use a little extra RAM. Browse to the program's executable file or its shortcut, right-click it, select Properties > Compatibility and check "Disable desktop composition." Run the program and Aero is turned off. It's restored when the program is shut down.

USE WINDOWS FASTER

Windows offers many tricks to help you work more efficiently

29 Instant PC Folder

Hold down the Windows key, press R to launch the Run box, type **.** and hit Return.

30 Access Your Users Folder

Launch the Run box, type **..** and press Return to launch the Users folder.

31 Access the Shell

To open your Startup folder, for example, click Start, type **shell:startup** and press Return.

32 Faster Searching

When you want to search for something in an Explorer window, just press F3.

33 See Recent Folders

Press F4 and you can choose recent folders from the History list much more quickly.

34 Refresh Now

If an Explorer window seems to be missing a file, folder, or drive, hit F5 to refresh the window.

35 Full-screen View

If you're examining an enormous list press F11 to toggle full-screen view.

36 Open a Folder Tree

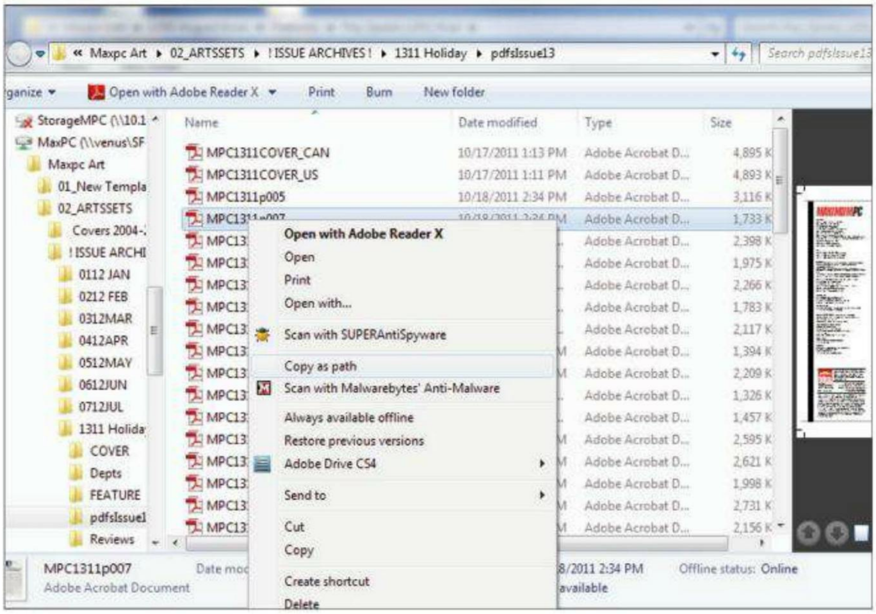
Press + on the numeric keypad to expand the currently selected folder.

37 Expand All Folders

Pressing * on the numeric keypad expands all folders below the current one.

38 Collapse all Folders

Press - on the numeric keypad to collapse the current folder.



39 COPY AS PATH

If you've ever found yourself hunting down a file in Explorer that you want to upload online only to have to retrace your steps once you've opened your browser, you need to know about Copy as Path. When you first locate the file in question, press Shift while right-clicking and choose the Copy as Path option. Now the location of your file is saved to the clipboard for easy deployment in your browser dialog.

40 BROWSE MENUS AT SPEED

A registry edit can shorten the pause before Windows menus expand, speeding up navigation. Launch regedit from the Start menu, go to HKEY_CURRENT_USER\Control Panel\Desktop, double-click MenuShowDelay, and select Decimal. Change the default—200, which is 0.2 seconds, works for us. The result is a noticeably more instant browsing experience, which is highly addictive. Once you've enjoyed Windows opening like lightning, going back to the normal setting will feel like watching a slow-motion replay.

41 SOLVE SLOW STARTS

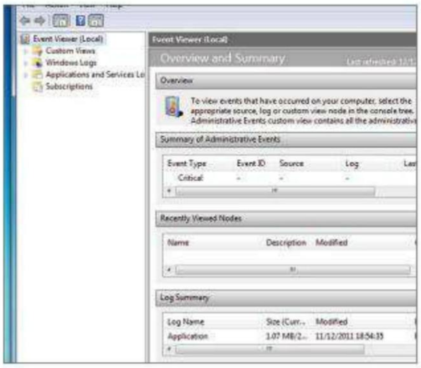
If Windows 7 is taking a long time to launch, or shut down, the Event Viewer may tell you which program or driver is responsible. Click Start, type **Eventvwr.msc**, and press Return. Expand the Applications and Services Logs section and browse to Microsoft\Windows\Diagnostic Performance\Operational. Scroll the events list on your PC to see if Windows knows who to blame for your performance issues.

42 FIX THE BOOT BUG

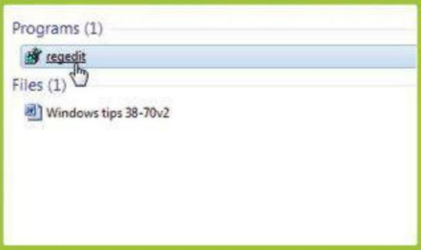
Is your Windows 7 desktop background a solid color? Then it may mean your PC takes 30 seconds longer than usual to boot. One solution is to change your background to an image, which will restore normal startup performance and make your desktop look better, as well. But if you're set on solid colors, then install a hotfix from Microsoft (support.microsoft.com/kb/977346) that will return your system to normal.

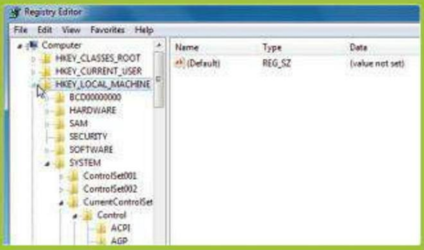
43 SEARCH THE WEB FROM YOUR START MENU

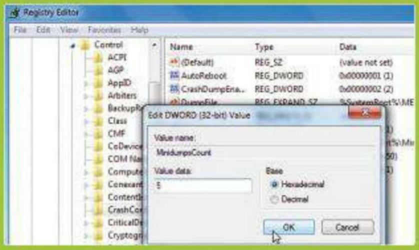
Windows 7 Professional and Ultimate users are able to set up the Start Search option to search the web. In Start Search type **gpedit** and open the app. Then navigate to User Configuration > Administrative Templates > Start Menu and Taskbar. Then double-click "Add Search Internet link to Start Menu." When you type a search into the Start menu, there will be the option to make it a web search, so you can more quickly get the information you need.



44 SAVE SPACE BY DUMPING CRASH DATA







1 Run regedit

Windows 7 keeps files on your last 50 crashes. However, if you'll never look at this data it's a waste of hard drive space, so you're better off getting rid of it. Type **regedit** into the Start menu and launch the executable.

2 Make the change

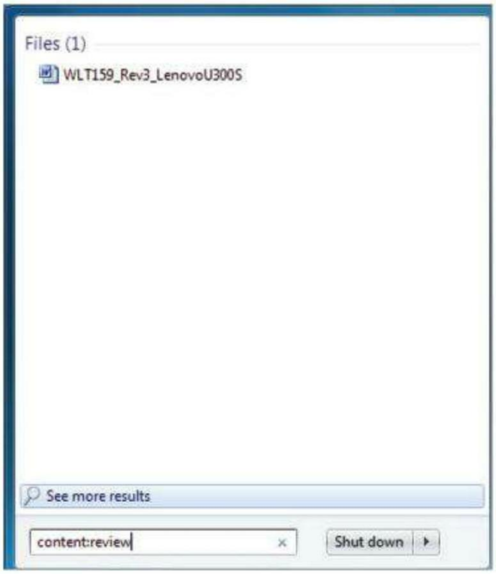
Browse to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\CrashControl. Double-click the entry called MiniDumpsCount and change the Value data according to how many crash files you want saved—five is enough.

3 Enjoy a faster machine

When you restart your PC, you'll have reclaimed some free space on your hard drive, which is useful for both older machines with small hard drives or newer SSD laptops, which have equally tiny disks.

45 RESTORE RUN

If you miss the Windows XP Run option, which was used by many to launch programs quickly, right-click the Start orb, select Properties > Customize, check the Run Command box, click OK, and a Run option now appears on the Start menu. Many of our tips feature the Run command and if you love sneaky shortcuts, this is a very easy way to start using Windows more quickly.



46 LAUNCH APPLETS FAST

Don't waste time browsing to the Control Panel for the right tool for making changes to your computer when you can launch it directly. To run Device Manager, for example, click Start, type **Device** in the search box and Windows should display a Device Manager link for you. Windows also responds to vague searches, so if you type **partition**, the disk management tool will be listed.

You can also type the applet's executable file name, such as: **devmgmt.msc** (Device Manager), **services.msc** (Services), **dfrg.msc** (Disk Defragmenter), **compmgmt.msc** (Computer Management), **diskmgmt.msc** (Disk Management), and **compmgmt.msc** (Computer Management Console).

47 OPEN WEBSITES WITH A KEYPRESS

In Internet Explorer, click Favorites, right-click a particular Favorite site, and select Properties. In the Shortcut Key box, press the key combination you'd like to launch the site—Ctrl + Alt + G for Google, say. Close your browser, press your shortcut key, and your default browser opens to display the site. This also works for any Windows programs.

48 ACCESS NETWORK FILES FASTER

To work on network files even when your PC isn't connected (in Windows 7 Professional, Ultimate, or Enterprise) there's an easy fix. When the network computer is available, browse to the file or folder you need, right-click it, select Always Available Offline so that it's checked and Windows makes a local copy available for you.

49 FIND THE RIGHT FILE

If you occasionally need to search the contents of files that haven't been indexed, just start your search with **content:**. This will tell Windows to go looking inside your files for the right information, even if Windows Search hasn't gone through and done it already. As this happens only a couple of times a day, new files might not be indexed, so it's well worth doing. Typing **content:zebra** into any search box locates files that have "zebra" in their contents, for instance.

50 SAVE TIME ON SWAPPING PRINTERS

To have Windows switch your default printer as you change networks, click Start, type **Devices**, and click Devices and Printers. Choose a printer and click Manage Default Printers. Select "Change my default printer when I change networks," choose a network and a default printer, and click Add. Repeat for other networks and pick a default printer. Now when you connect to a network, Windows will set a defined printer.

51-71 WINDOWS KEY SHORTCUTS

The Windows key has many uses. Here are just a few...

Windows + Left Arrow
Dock the current window left

Windows + Right Arrow
Dock the current window right

Windows + Up Arrow
Maximize the current window

Windows + Down Arrow
Minimize the current window

Windows + M
Minimize all windows

Windows + Shift + M
Maximize windows

Windows + Space
Make all windows transparent

Windows + L
Lock your desktop

Windows + B
Move the focus to system tray

Windows + E
Launch My Computer tray

Windows + F
Open the Find dialog

Windows + Ctrl + F
Open the Find Computer dialog

Windows + Pause
Display System Properties

Windows + [+]
Zoom in on the screen

Windows + [-]
Zoom out from the screen

Windows + U
Open Ease of Access Center

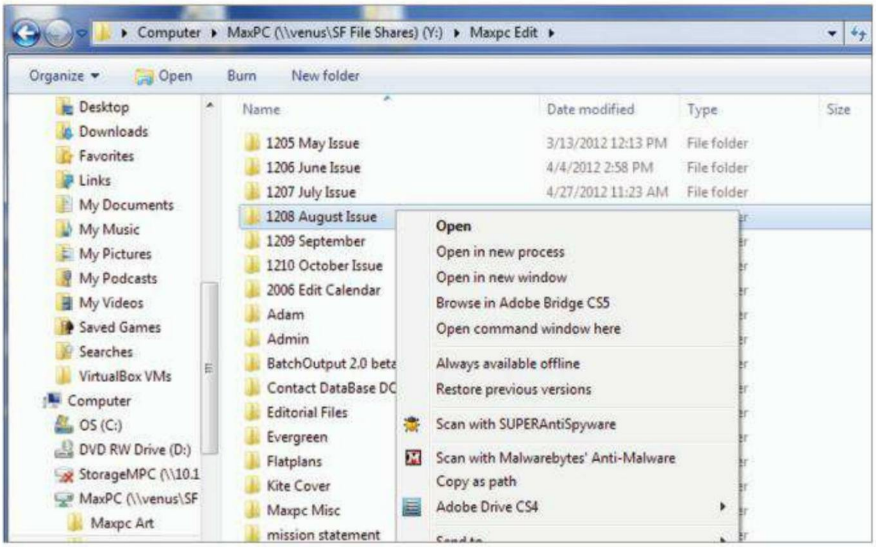
Windows + T
Cycle through taskbar items

Windows + Tab
Cycle through open windows

Windows + R
Open the Run command

Windows + L
Lock your Windows PC

Windows + F1
Open the Help folder



72 SPEED UP START MENU SEARCHES

Right-click the Start button and select Properties. Click Customize, scroll down the list of available options, and select "Search without public folders" under "Search other files and libraries." Click OK and results should appear much quicker than before, as there are far fewer places to search. Public folders are rarely used by most people, so axing them in search is a cost-free speed up trick.

73 LOAD WEBSITES MORE QUICKLY

By changing your DNS server to OpenDNS, you're able to browse the Internet more quickly and safely. Visit www.opendns.com/start to sign up for a free basic plan.

74 SCALE BACK VISUAL EFFECTS

If you don't have a lot of memory installed (1GB in Windows 7 or Windows Vista, or 256MB in Windows XP), click Start, right-click Computer or My Computer, and select Properties. Select "Advanced system settings" (Advanced tab in Windows XP) and under Performance click Settings. Select "Adjust for best performance" and click OK to give yourself a speed boost.

75 QUICKLY ACCESS THE COMMAND PROMPT

Did you know that you can open the command prompt from any folder? Press the Shift key while right-clicking the folder and then choose the option to "Open command window here." This trick also works on the desktop.

76 GIVE YOUR PC A HELPING HAND

If you have a spare USB flash drive, you may be able to use it to give your PC a small boost. Plug the drive in and—if prompted—choose "Speed up my system." Otherwise, click Start > Computer, right-click your flash drive and choose Properties, then choose "Use this device to enable ReadyBoost." Mind you, this likely won't improve performance on a 64-bit install of Windows, but if you're rocking a 32-bit version of the OS you should check it out.

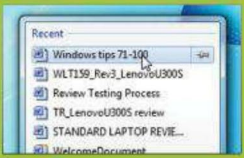
77 MAKE YOUR PC AS GOOD AS NEW

Get that shop-fresh feeling back by reinstalling Windows using the disc that came with your PC. When you're done, go to Start > Search, type **Back up and Restore** and set a restore point, so you can roll back to this clean setup in the future, bypassing the installation process.

78 MANAGE YOUR FONTS

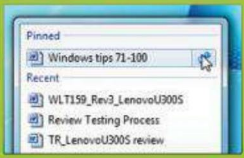
Over time, the number of fonts installed on your PC swells and each one uses up precious system resources. Use a program such as AMP Font Viewer (www.ampsoft.net) to remove those fonts you never use. Windows Vista and Windows 7 users should right-click the program shortcut, choose Properties > Compatibility and tick "Run this program as an administrator" for it to run properly.

FIVE WAYS JUMP LISTS CAN SAVE YOU TIME



79 Launch Items

To open a Jump List, simply right-click a program icon on your taskbar to see a list of recently opened files associated with that application. It's quicker to launch a file from here than from the file's location.

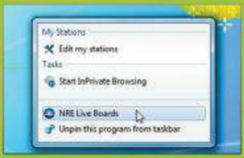


80 Pin Items

Only the 10 most recent items are shown, but you can "pin" your favorite items to a Jump List so they're shown permanently. Click the pin to have them locked and click it again to unpin.

81 Get in Control

You can add more recent items by right-clicking the taskbar, selecting Properties, and then going to the Start menu tab. At the bottom you can adjust the number of recent items to display.



82 Pin Sites

You can pin the websites you browse regularly to the taskbar, enabling you to launch them quickly. In your browser, just click the icon next to the URL and drag it down to the taskbar to add it.

83 Get More

If you use Internet Explorer 9, some websites have added functionality and are quicker to use when pinned. Try dragging Twitter or Facebook to the taskbar from Internet Explorer 9, and you'll see the difference.

84 CHECK DEFRAG

One of the oldest tricks for speeding up a PC's performance is hard drive defragmentation. Applicable only to mechanical drives (as opposed to SSDs), defragging takes all the various fragments of data that get scattered across hard disks over time and puts them in nice order so the drive doesn't have to work as hard at data retrieval. With Vista and Win7, defrags should happen automatically. To ensure that defragmentation is enabled on your hard drive (and not enabled on your SSD), right-click your drive's icon in Explorer, select Properties, then Tools, and click the Defragment Now button. Besides verifying the defrag status, you can select a schedule that will have the least impact on your computing activities.

85 TWEAK LIBRARY SETTINGS

Edit an existing Library or create a new one by clicking Start > Computer followed by Libraries in the Navigation pane. Click New Library or right-click an existing Library and choose Properties to include new folders in the library or remove existing ones.

86 SET UP YOUR FAVORITE FOLDERS

If you want even quicker access to specific folders—again from any folder window or when choosing Open or Save in a program —just browse to the drive or directory containing your target folder, then click and drag it into place on the Navigation pane under Favorites.

87 ADD PROGRAMS TO FAVORITES LIST

It's also possible to add programs to Explorer's Favorites list, although the process is a bit different. Open Windows Explorer and type C:\Users\[user name]\Links in the address bar (replacing [user name] with your user account name). Now drag and drop program shortcuts from the Start menu, desktop, or other location into the Links folder. Those program links will now appear in your Favorites list.

88 USE THE 'SEND TO' FOLDER

There are a number of useful shortcuts available to any file or folder, simply by right-clicking it and choosing Send To. You can open a file in a specific program, compress it into a zipped folder in order to save space, and create desktop shortcuts. And that's just for starters.

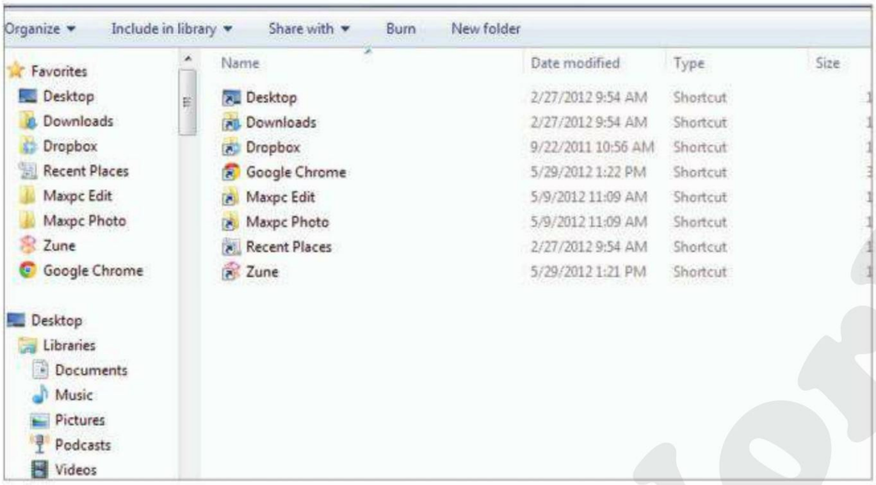
89 INVERT SELECTION

If you need to select a large group of nonconsecutive files within a folder, it's quicker to select the files you don't need before choosing Edit > Invert Selection. If you can't find this at first, don't worry—the Edit menu is hidden by default in Windows 7 and Windows Vista. Choose Organize > Folder and Search Options > View, then tick "Always show menus" and click OK to show it.

90 SPEED UP INTERNET EXPLORER

If Internet Explorer takes an age to open, select Tools > Internet Options > Programs. Click "Manage add-ons" and view the Load Times for each add-on (you may need to scroll to the right to view this). Add-ons cause Internet Explorer to run more slowly, so have a go at disabling sluggish add-ons unless they're important, such as those linked to your security program.

This isn't a problem that's confined to Internet Explorer. Firefox is renowned for its array of add-ons. If you've added applets that you're not using, slash them and enjoy the feeling of a more responsive browser.



INTERNET EXPLORER SPEED-UP TIPS

Make Windows' web services work faster for you, too

91 Alt + D
Selects the text in the Address bar

92 F4
Displays a list of addresses you have typed

93 Ctrl + Left Arrow
When in the Address bar, move the cursor left to the next logical break in the address (period or slash)

94 CTRL + RIGHT ARROW
When in the Address bar, move the cursor right to the next logical break in the address (period or slash)

95 CTRL + ENTER
Add www. to the beginning and .com to the end of the text typed in the Address bar

96 CTRL + SHIFT+ DEL
Delete browsing history.

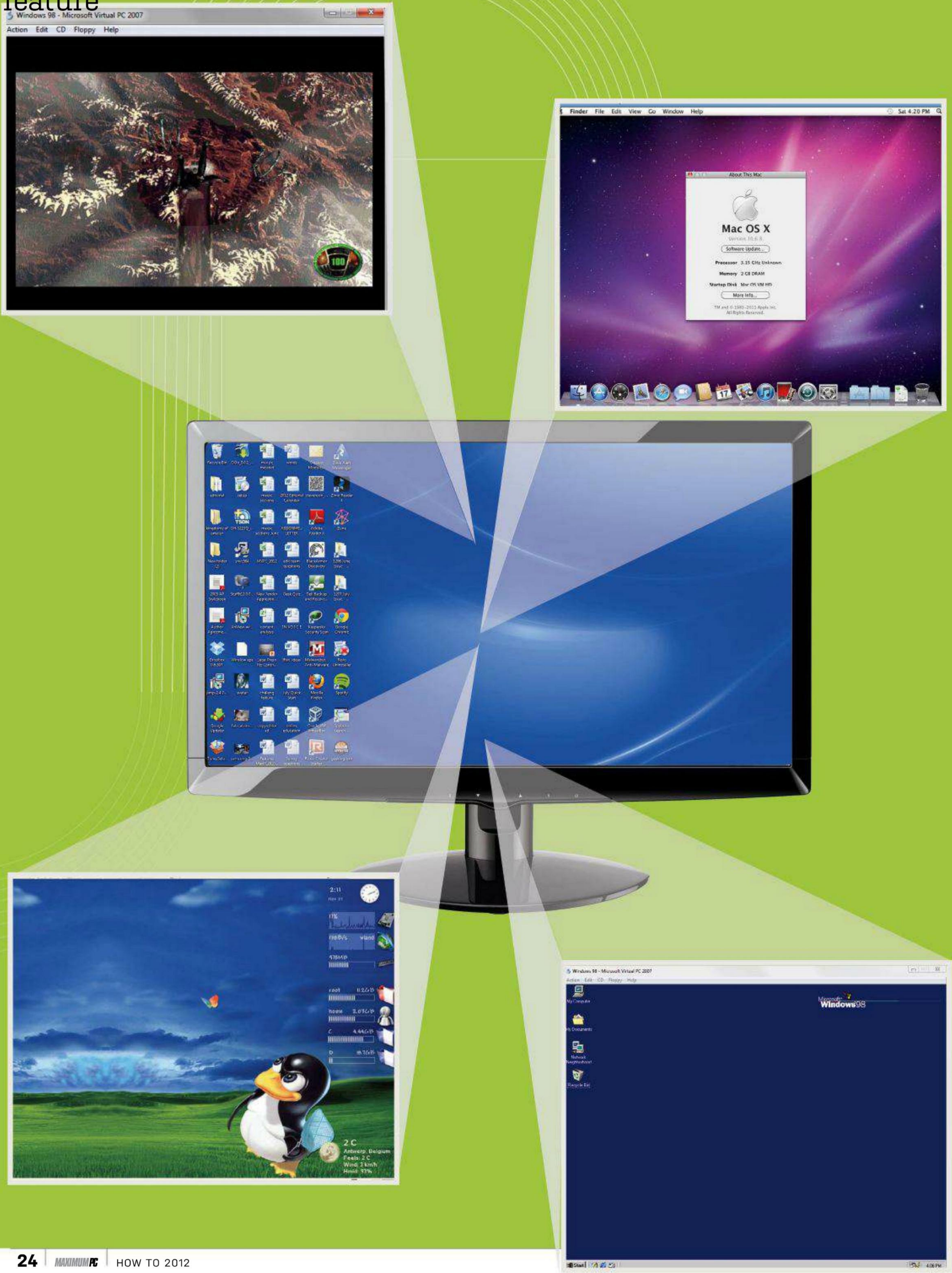
97 CTRL + SHIFT + P
Open an InPrivate Browsing window

98 CTRL + T
Open a new tab

99 CTRL + 1-9
Switch to a specific tab number

100 ALT + HOME
Return to your home page

WorldMags


Windows 98 - Microsoft Virtual PC 2007
Action Edit CD Floppy Help
Finder File Edit View Go Window Help
Sat 4:20 PM
About This Mac
Mac OS X
Software Update...
Processor 3.15 GHz Unknown
Memory 2 GB DRAM
More Info...
2 C
Antwerp, Belgium
Windows98

By Marco Chiappetta

WELCOME TO THE VIRTUAL MACHINE

HOW **CREATING PCs WITHIN YOUR PC** CAN OPEN NEW AVENUES OF PRODUCTIVITY, EXPERIMENTATION, AND FUN!

VIRTUALIZATION—the act of creating a virtual PC within a PC, complete with its own OS—was once an enterprise-class technology reserved for only the most ardent sysadmins. Setting up virtual machines on otherwise underutilized physical servers gave them the ability to leverage every bit of CPU horsepower available, instead of wasting unused CPU cycles with unproductive idle time.

As is the case with many technologies initially designed for enterprise, however, virtualization has since trickled down into the consumer space. The reasons for using virtualization on the desktop may differ from the enterprise space, but there are clear benefits nonetheless.

Using virtual machines allows you to experiment with different operating systems and software without risking damage to your host OS or needing any additional hardware. Virtual machines also give you the ability to evaluate applications in a firewalled environment or even run applications that may be incompatible with the host OS. Virtual machines can also be used to extend the lifespan of applications or games that won't run on the latest operating systems. If you've ever had a rogue application hose your rig's OS installation or a game that wouldn't run after an OS upgrade, a virtual machine would probably have helped.

All you need to run a virtual machine is virtualization software (like the packages we'll be showing you here), a modern processor, preferably with virtualization support in hardware for best performance (and the feature enabled in your system BIOS), the disk space necessary to install the operating systems and applications you'd like to use, and valid licenses for whatever OSes you plan to install. That's it. The process is really straightforward and extremely useful once you've gotten the gist.

To help you on your way, we've reviewed three excellent free VM options: Oracle VM VirtualBox, VMware Player, and Virtual PC. We'll tell you how they compare in terms of features and performance, and then we'll walk you through a couple of fun projects using a VM.

ORACLE VM VIRTUALBOX

Features a daunting array of options

VirtualBox is Oracle's free virtualization tool, which is being distributed as Open Source Software under the terms of the GNU General Public License (GPL). Don't let the fact that VirtualBox is free fool you, though. It may be a no-cost solution, but it's a feature-rich product, with support for a broad range of both host and guest operating systems. VirtualBox is updated frequently too, which is another plus.

Installing VirtualBox is straightforward and, as you'll see in the sidebar on the next page, performance is quite good. VirtualBox also offers the widest range of virtual hardware options for your VM of the three products featured here. But with such a wide range of features and OS support comes a bit of complexity. Although we think that seasoned enthusiasts will have little trouble navigating through VirtualBox's vast array of configuration menus, the sheer number of options may be daunting to some.

Once configured, however, VirtualBox is a good tool that should serve users well. We particularly like VirtualBox's ability to take multiple snapshots of a VM, should you need to quickly revert to a previous state. We also like that VirtualBox makes it easy to create shortcuts in the host OS to your virtual machines, so launching a VM is never more than a couple of clicks away.

The VirtualBox Manager main menu displays myriad information about the virtual machine's guest OS and configuration.

If there's one area where VirtualBox is lacking, it's in its integration with the host OS. VirtualBox does offer scalable and seamless modes that work fairly well, but we experienced a few graphical anomalies when using them and thought VMware did a somewhat better job with host OS integration. As of this writing, VirtualBox's Direct3D acceleration is still in the experimental phase, as well, although OpenGL support has been available for a while. More common Direct3D features, like those necessary to run Aero and some games, worked with VirtualBox; but as you'll see in the performance sidebar, a video-rendering test that leverages the host GPU failed.

VERDICT **8** — **Oracle VM VirtualBox**

www.virtualbox.org

VMWARE PLAYER

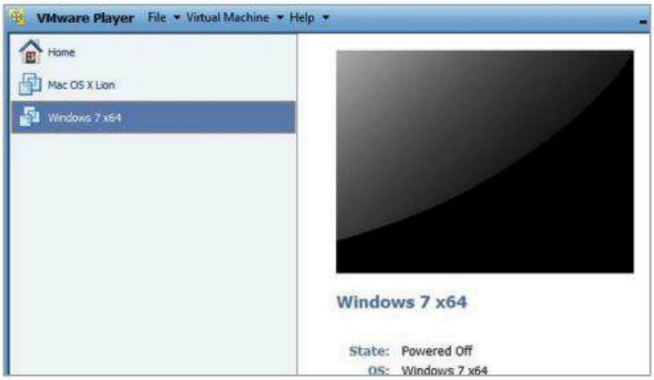
Free, pared-down version of VMware Workstation is no slouch

VMware Workstation is arguably one the best paid virtualization products available for Windows users, so we were not surprised to find that its scaled-down, free-to-download VMware Player counterpart is a great tool, as well. A few relatively minor quibbles hold VMware Player back from earning a Kick Ass award, however.

For one, VMware Player is limited to using only four virtual CPU cores. That's probably fine for the vast majority of users, but we tested the app on a 12-core/24-thread system and didn't like to see our resources go to waste. What's more annoying, the virtual machine configuration menu actually offered six- and eight-core options. When launching a VM with six or eight cores, though, an error message would pop up saying only four cores were supported. How about removing the six- and eight-core options so users don't waste their time?

Another thing we didn't like about VMware Player was that it installed multiple services on the host OS that started automatically with Windows, regardless of whether the tool was running. Despite offering OpenGL, Direct3D, and DirectDraw acceleration, VMware Player was unable to complete our video rendering benchmark test. And it doesn't have the ability to take multiple snapshots, either.

On the plus side, however, we found VMware Player's overall performance to be excellent. Disk and memory performance were better than with the others, and the user experience in general just felt more fluid. VMware Player's Unity Mode, which allows applications running through the virtual machine to appear in separate windows as if they were on the host OS, worked perfectly. VMware Player also seemed to work with the broadest range of peripherals—it even allowed an Asus USB Bluetooth module to function properly under OS X.



VMware Player's main menu lists all virtual machines along with some basic configuration information, in addition to a window with a real-time view of the guest OS.

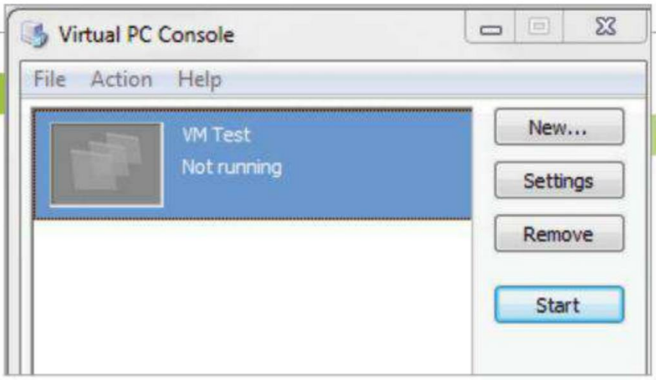
VMware Player may not have the same capabilities and tighter host OS integration capabilities of its paid big brother, but as far as free virtualization tools go, it's one heck of a package.

VERDICT **9** — **VMware Player**

www.vmware.com

VIRTUAL PC 2007 SP1

It's a little long in the tooth, but still decent



The Virtual PC Console is as simple as can be. Virtual machines are listed next to a few buttons used for creating, configuring, removing, or starting a VM.

It has been a few years since Microsoft updated Virtual PC, but it remains one of only a few free virtualization tools available for Windows users, so we decided to take it for a spin anyway. Despite its age and lack of features relative to VirtualBox or VMware Player, Virtual PC is still a pretty good tool, and it's the easiest to use of the bunch.

In light of competing offerings, Virtual PC 2007 doesn't have many standout features. One feature that does stand out, however, is Virtual PC's Undo Disks. With Undo Disks enabled, a user can start a virtual machine and make whatever changes or additions to the VM he or she wants, but the changes are stored in the Undo Disks; the user can selectively decide to undo (or apply) any of the changes. We found the Undo Disks feature to be quite useful for reverting the VM back to a pristine state when experimenting with different applications and software inside the virtual machine. On the flip side, Virtual PC was the only app of the bunch to not offer Direct3D acceleration; VMware Player and VirtualBox have the clear edge in support for hardware 3D acceleration.

Overall performance with Virtual PC also trailed the other offerings, which doesn't bode very well for enthusiasts looking to experiment with virtualization. Its lack of support for 64-bit host OSes is also a major drawback.

VERDICT 6

Virtual PC 2007 SP1

www.microsoft.com/windows/virtual-pc

VM PERFORMANCE TESTED

To quantify the performance of each of the virtualization tools featured in this article, we tested Windows 7-based virtual machines running under VMware Player, VirtualBox, and Virtual PC on an ultra-powerful, 12-core/24-thread, dual-3.33GHz Intel Xeon 5680-equipped workstation, complete with 24GB of RAM, dual Radeon HD 6970 cards, and dual Crucial C300 solid-state drives running in a RAID 0 configuration. Our goal was to give each virtual machine plenty of breathing room and also to maximize performance. Keep in mind that on lower-end systems, similarly configured virtual machines are likely to perform differently due to contention for host CPU and memory resources.

On account of the various limitations of each of the free virtualization suites, performance was all over the map. Virtual PC wouldn't allow us to crank up the number of virtual CPU cores even though hardware virtualization was enabled, so it was limited to a single thread, hence the much lower score in the multithreaded-processor arithmetic benchmark. Virtual PC was also the only virtualization tool that wouldn't allow us to install a 64-bit edition of Windows 7, so it was limited to a 32-bit OS. VMware Player was limited to four virtual CPU cores, even though the settings menu allows up to eight cores to be selected. VirtualBox allows for up to 32 virtual CPU cores, but we found that increasing the number of virtual cores beyond the number of physical cores in the system resulted in erratic performance and instability of the VM. Each of the VMs was configured with 4GB of memory and a 40GB virtual HD.

Although VirtualBox put up the best CPU score, we found that VMware Player offered the best overall experience. The VMware virtual machine simply felt more responsive, due to its better per-core performance, and memory and file system performance. Still, all three of the applications offered acceptable performance and were perfectly usable with a wide variety of applications. We should point out, however, that despite enabling 3D acceleration where possible, all three virtualization suites failed to run the Video Rendering benchmark. It appears that despite support for DirectDraw and Direct3D in VMWare Player and VirtualBox, GPU emulation is still far from perfect.

BENCHMARKS

	WINDOWS 7 X64 (NATIVE)	VMWARE PLAYER (4 CORES)	VIRTUALBOX (12 CORES)	VIRTUAL PC (1 CORE)
SiSoft SANDRA 2012				
Processor Arithmetic Benchmark (aggregate arithmetic performance)	260.87 GOPS	59.31 GOPS (14.82 GOPS per core)	103.86 GOPS (8.66 GOPS per core) (52.58 GOPS w/ 4 cores)	14 GOPS
Memory Bandwidth Benchmark (aggregate memory performance)	29.3GB/s	15.89GB/s	9.86GB/s	8.5GB/s
File Systems Benchmark (drive score)	526.57MB/s	498.55MB/s	439.52MB/s	287.68MB/s
Video Rendering Benchmark (aggregate shader performance)	399.25MP/s	WNR	WNR	WNR

Host PC: Intel Xeon 5680 x2, 24GB DDR3-1333, Radeon HD 6970 x2, Crucial C300 x2 (RAID 0), Windows 7 Ultimate x64.

THE VIRTUAL HACKINTOSH

Use a VM to install OS X on your PC

Perhaps it's due to the popularity of the iPhone and iPad and their seamless integration with OS X, but whatever the reason, there has been a huge uptick in the number of enthusiasts looking to build a "Hackintosh" system. If you're unfamiliar with the term, a Hackintosh is basically a DIY PC capable of running Mac OS X on non-Apple hardware—in other words a hacked Macintosh.

Cobbling together a physical Hackintosh isn't necessary with virtualization, however. There are a number of ways to configure a virtual Hackintosh provided you've got the right software and are willing to disregard Apple's OS X EULA (uh, *yeah*).

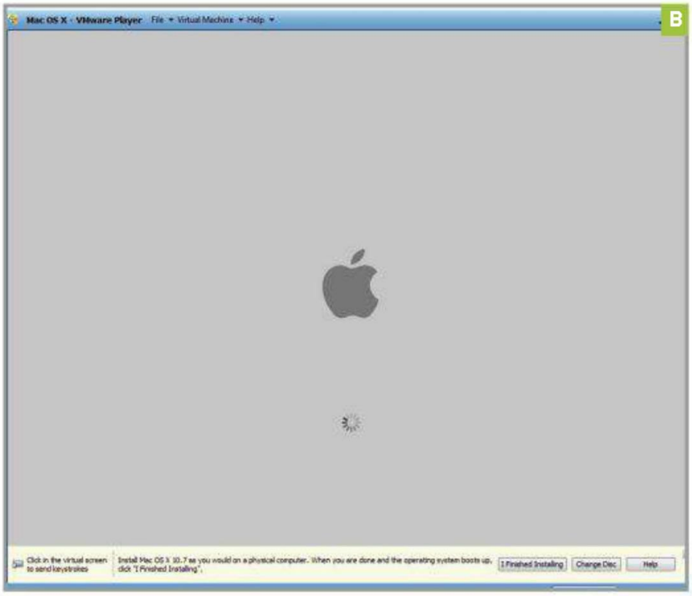
If you do some searching, you'll find that there are multiple methods to pull off a project like this one using an array of questionable and not-so-questionable software. We prefer a method that requires a legit OS X installation DVD (or an ISO made from the disk), VMware Player (or VMware Workstation), VMware Tools, and an unlocker tool created by donk, an Insanelymac.com forum member. The unlocker (unlock-all v1.02 as of this writing) modifies a few VMware files, which in turn gives users the ability to select Apple Mac OS X as a guest operating system on non-native OS X systems. VMware Tools is normally installed from the Virtual Machine drop-down that's available once the guest OS is installed, but since OS X isn't officially supported by VMware Player under Windows, the ISO isn't available and must be mounted manually. VMware Tools installs some drivers and tweaks to the guest OS for better video performance and mouse integration, among a few other tweaks.

1 INSTALL THE VM To configure your virtual Hackintosh, gather up your Mac OS X installation disk or ISO (we used an ISO), download donk's VMware unlocker (bit.ly/yju0HJ), download the VMware Tools ISO (bit.ly/ISgCzw), and download and install VMware Player (www.vmware.com). Once VMware has been installed, launch it just to make sure it's working correctly, then exit VMware and restart your system.

» When your system has fully restarted, disable any antivirus and/or antimalware utilities and then run the VMware unlocker as an administrator (right-click the necessary batch file and select "Run as administrator" from the menu). A command prompt window will open for a few moments as the unlocker does its thing. It should work from within Windows 7, but if it doesn't, you may have to run the batch file from a command line with elevated privileges. To do this, click the Start button, type cmd, and then hit Ctrl+Shift+Enter to run as administrator. From there, change the directory to the location of the unlocker by typing CD and then entering the directory name. From there, type install.cmd and the unlocker should do its trick.

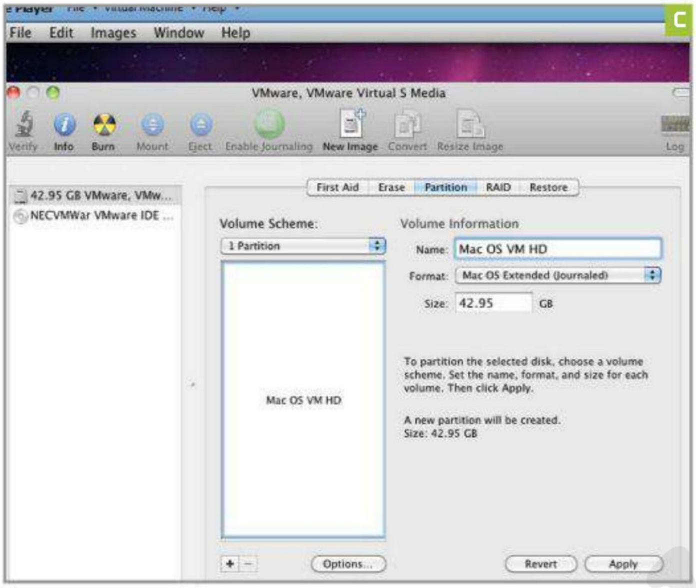
» After you've run the unlocker tool, launch VMware and select the option to create a new virtual machine. On the initial screen, choose your OS X installation media in the Install From menu, then click Next. If the unlocker worked correctly, Apple Mac OS X will be an option in the guest operating systems menu in the subsequent window (image A). Select OS X and then select your version from the drop-down menu at the bottom of the window. Then proceed through the rest of the VM configuration screens and choose the virtual hardware configuration you'd like—we set up our VM with a 40GB virtual HD stored as a single file (choosing the option to split it into multiple files will adversely affect performance) and 2GB of RAM.

2 INSTALL OS X Once the initial setup of the virtual machine is complete, follow the onscreen prompts and begin the operating system installation. The VM will boot in a new window and launch the Mac OS X installer (image B). Continue on through the early stages of the OS X installation, clicking Next or Continue as nec-



essary, until you hit the Welcome screen.

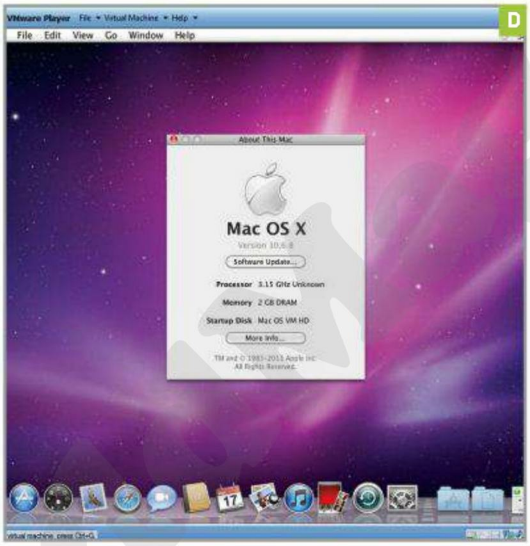
» When you reach the Welcome screen during the OS X installation, the virtual hard drive created during the initial VM setup phase will have to be partitioned and formatted, otherwise it won't be found by the installer. Click the Utilities menu at the top of the OS X window and run the Disk Utility. When the Disk Utility opens, select the VMware HD, and then choose the number of partitions you would like in the Volume Scheme drop-down menu



(we chose 1). Then size the partition (or partitions) as you'd like, name it, and click Apply to format (image C). When the process is complete, close the Disk Utility and proceed with the OS X installation.

3 FINISHING TOUCHES After the OS X installation is complete, and you choose a login name and password, there are a few more things left to do before you can start enjoying your virtual Hackintosh. The first is to mount the VMware Tools ISO and install the tools. Installing the VMware tools improves performance, allows you to select native monitor resolutions, and improves mouse-pointer integration. Once the VMware Tools installation is complete, update OS X as necessary and you're done (image D).

» We should mention that we completed this process on three different systems without incident (a 2P Xeon workstation, a Core i7 desktop system, and a Core i3 notebook), but your mileage may vary depending on your host system's particular hardware and software configuration. If you complete this project and find that you don't have audio, or running updates breaks OS X, or whatever, do some searching and you'll likely find a solution.



OLD-SCHOOL GAMING

Don't let your new PC keep you from playing your favorite games of yore

We think you'll all agree that moving to the NT kernel in the consumer space and unifying the NT and 95/98 branches with Windows XP was a wise move on Microsoft's part. It took a while, but that unification ultimately evolved into Windows 7, which we would argue is Microsoft's best OS to date.

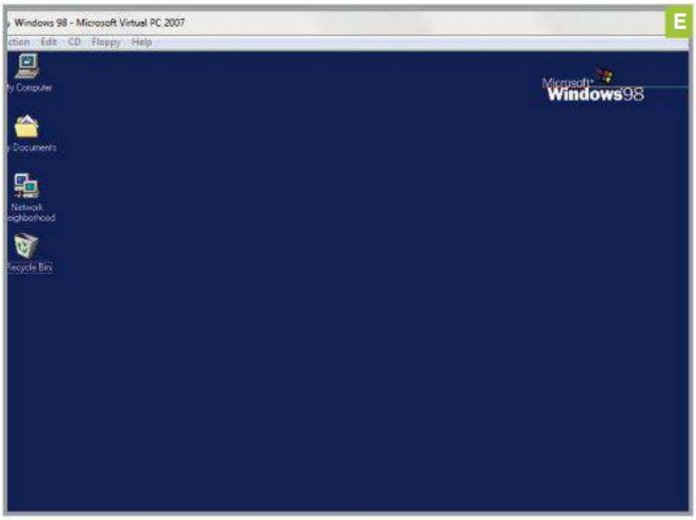
Unfortunately, the move to an NT kernel with Windows XP broke many applications and games that were designed with only Windows 95/98 in mind. Although there were many patches and updates made over the years that improved compatibility with older apps and games, there are still a large number of them that won't run on more current versions of Windows.

What's a retro-gamer to do? Well, run Windows 98 in a virtual machine, of course!

1 INSTALL THE VM To run Windows 98 in a virtual machine so that you can enjoy your older games all over again, you'll need your Windows 98 installation CD or a pre-made Windows 98 VM (there are myriad available for download), as well as one of the virtualization utilities featured here—we chose Virtual PC because it has a Windows 98 preset that makes configuration a snap.

» Install Virtual PC, launch it, and click the New button to bring up the New Virtual Machine Wizard. Click Next on the Welcome screen, and in the Options menu select "Create a new virtual machine" if you plan to start from scratch, or "Add an existing virtual machine" if you downloaded a preconfigured VM. Then click Next.

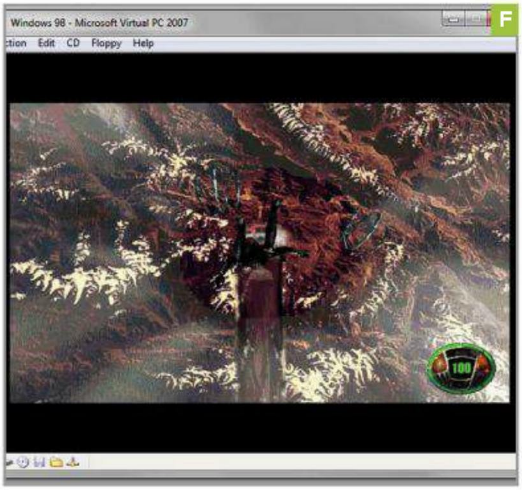
» If you go the preconfigured route, on the subsequent screen, browse to the preconfigured VM file, select it, and you're ready to go. If starting from scratch, name your virtual machine, click Next, and you'll be brought to the Operating System menu. Choose Windows 98 from the drop-down menu, click Next, and follow the onscreen prompts to configure the VM (remember to set aside enough disk space to accommodate your games). When complete, start the VM and install Windows 98 (image E).



E

2 INSTALL VM ADDITIONS Once you've got Windows 98 installed, it's almost time to get your game on. The first order of business is installing the VM additions in Virtual PC. Start your VM and in the Action menu select "Install or update Virtual Machine additions." Installing the VM Additions improves performance, optimizes video drivers, synchronizes the time, and offers better mouse integration, so you'll be able to move into and out of the VM without clicking.

» After installing the Virtual Machine Additions, go ahead and install some games. We fired up a few classics like MDK and Grim Fandango and were immediately catapulted back in time to the era of code wheels and answering questions from the manual to launch a game (image F). Ahh, the good old days!



F

EMULATION VS. VIRTUALIZATION

While extremely useful for many situations, there are times when virtualization isn't ideal and an emulator is preferable. Virtualization and emulation are closely related, but differ in a few key ways. Virtualization allows users to configure virtual machines outfitted with similar hardware and processors as the host system, whereas emulation simulates different hardware and processor configurations in software. All operating systems installed on virtual machines running on a host system with a Core i7-2700K processor will recognize the host CPU as a Core i7-2700K (or Intel x86 CPU). However, an emulator can mimic other processors and hardware through software. Emulators are what allow you to run old Commodore 64 or NES games on a PC, for example.

A popular emulator for the PC is DOSBox. As its name suggests, DOSBox emulates an aged, pre-Windows DOS environment. That environment has an emulated Intel x86 CPU; Creative Labs Sound Blaster audio; CGA/EGA/VGA/Tandy video modes; and mouse, joystick, and modem support. DOSBox is a great tool for users looking to enjoy their early DOS games that will no longer run from a command prompt in Windows.

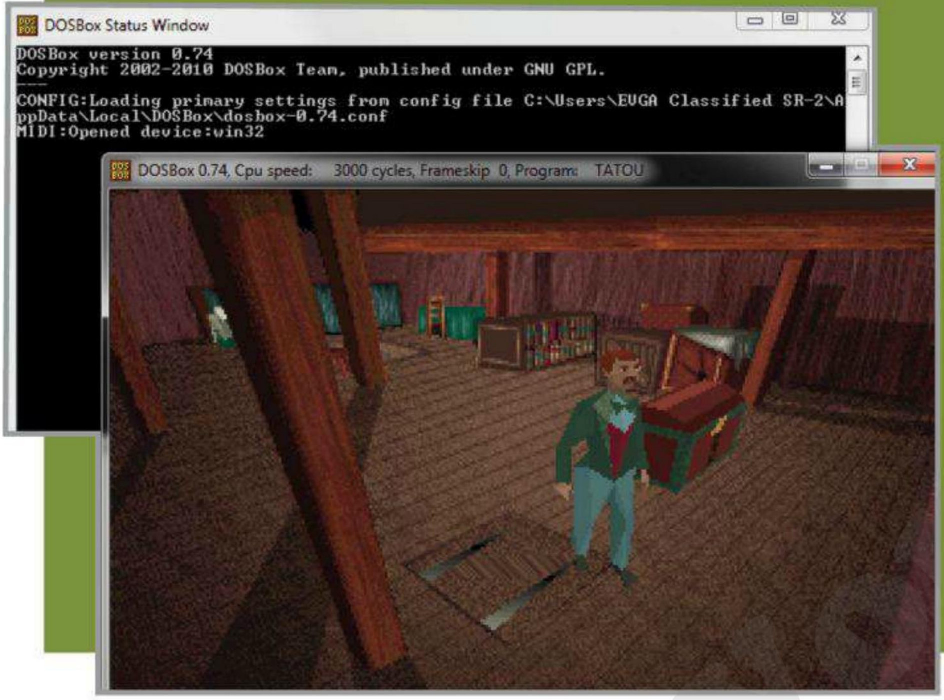
Using DOSBox is very easy. Head to www.dosbox.com, download the tool, and simply install it. Then create a folder where you'd like to install your DOS games—on our system, we used D:\dos-games\. At this point you could run DOSBox and manually mount your installation directory and optical drive, but it's more convenient to edit DOSBox's configuration file to automatically mount drives for you.

To have your drives automatically mounted at run time, head into the C:\Users\[username]\AppData\Local\DOSBox\ directory and open the dosbox-0.7x.conf file in your favorite text editor. Scroll to the bottom of the file, find the [autoexec] section and you'll need to add two lines:

```
mount c d:\dos-games
mount d e:\ -t cdrom
```

Substitute "d:\dos-games" in the first line for the path to the directory you created for your games. And substitute "e:\" for the drive letter of your physical optical drive. With the two lines as they appear here, DOSBox's drive C: will connect to our D:\dos-games directory and DOSBox's drive D: will connect to the host system's optical drive, which is drive E:.

With DOSBox configured, the only thing left to do is install and play some games. Install or copy your game files into the folder you created earlier, then run DOSBox, navigate to the game directory, run its executable, and you're ready to go. Should you run into any issues, consult the DOSBox readme file for tips on how to alter processor speeds, input methods, or video and audio modes, among many other things.



Alone in the Dark running under DOSBox.

HOW TO RID YOUR PC OF MALWARE

Four steps that will keep your PC happy, healthy, and crap-free!

By David Murphy

MALWARE SUCKS. In the best-case scenario, it craps up your system with unwanted files and occasionally makes itself known in the form of a persistent pop-up window or annoying browser-based toolbar. In the worst-case scenario, malware completely takes over your desktop or laptop and ruins your life.

Your system slows to a crawl. You can't even boot into Windows in the time it takes you to walk to the kitchen and back. Your data gets sent off to a faraway Internet land or, worse, your actual keystrokes are recorded for some unsavory individual to see. Malware locks down your browser, making you unable to actually do any browsing without being carted off to some bogus domain. You can barely run a program in Windows without getting bombarded by fake advertisements, programs, and dancing people on your desktop.

We can't make this stuff up.

So what's a computer enthusiast to do? Step zero: Read this guide, because we're going to walk you through all the key details you need to know to both rid your computer of this junk and keep it free of downloaded nasties forevermore.

1 Don't Browse Blindly

WHAT'S THAT? The first step doesn't inolve files to download or utilities to blast malware from your system? Exactly. The most important thing you have to realize in order to fight the great malware war is that you, and you alone, are the first line of defense. You have only yourself to blame if your computer is completely over-ridden with problem-causing, yet preventable, programs.

Much of the more annoying malware that you can accidentally befriend requires your cooperation in order to get on your system in the first place. You have to download and run an unknown file or agree to have a toolbar placed on your system as part of a software installation routine. You have to accept certain kinds of JavaScript or be fooled by scam websites that claim to be running a virus scan on your system (to name one such harrowing tale).

In short, you have to let your guard down.

So how do you protect yourself against your own habits? Keep in mind this rule of thumb: If it's too good to be true, if it looks strange, or if it's completely unknown to you, don't run it. Don't install it. Don't accept it, don't hit "yes" to it, and don't let it get anywhere near your system. Google, Bing, and Yahoo are your friends. Use them to find more information about a given program before you agree to let it do anything on your system. Don't surf the Internet blindly, assuming that everything on a website is safe for your system to digest.

The astute among you will notice that this isn't a proper security scan: It's malware, and it just made life very difficult for this system's user.

Ignore this warning image (or any variant) when you're browsing the Internet, and you could be in for a world of digital hurt.

2 Batten Down Your Browser

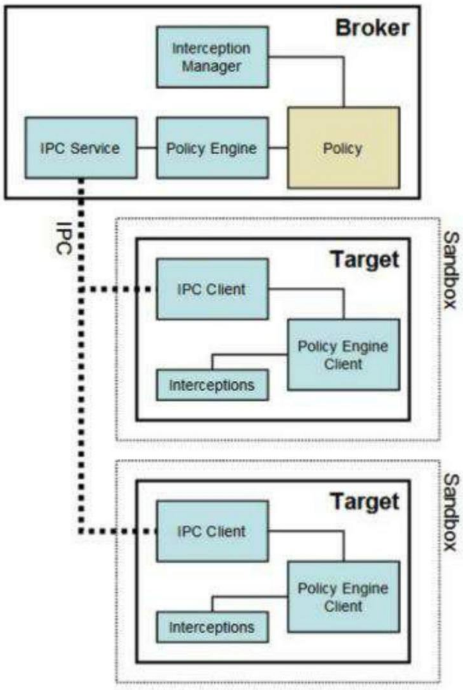
WE MENTIONED that a bunch of malware can come through your browser—'tis a shame, we know. Vulnerabilities in browsers and plugins (and user error) can bring your system to its digital knees faster than you can spell the word "crap" in "crapware." So let's start with the simplest step: Stop using an outdated, insecure browser. Make sure you're at least sporting the latest version of one of the Big Three: Internet Explorer, Firefox, or Chrome.

But which? Various research reports have dubbed each of these three browsers as the "best in class" against malware and other social-driven attacks. Our personal preference when it comes to safety is Google's Chrome browser for three reasons: First, it's the only browser to use sandboxing as its primary defense mechanism. This method combines a JavaScript virtual machine with an OS-level sandbox to prevent successful attacks against the browser's rendering engine from affecting a user's file system. Second, Chrome has been, hands down, the hardiest survivor of each year's Pwn2Own hacking contest at the CanSecWest security conference: Talk about a real-world verification of its security capabilities, eh? Third, Google updates the Adobe Flash and Acrobat Reader modules itself. So if you're running the latest version of Chrome, you're running the latest, most secure versions of Flash and Acrobat Reader available (click the wrench icon and About Google Chrome to verify that you're running the latest updates).

But we're just getting started. JavaScript vulnerabilities—including blatant attacks that rely on a user's cooperation to work—can just as easily affect your browser. If you're rocking Firefox, grab an extension called NoScript, which will allow you to disable a page's plugin elements (including JavaScript and Flash!) by default, unless you trust the site enough to give 'em a go. Chrome doesn't have an add-on for the same feature, but you can disable JavaScript by default in the browser's Under the Hood settings section. And if you want to specifically allow a site's JavaScript to function, just click the associated X icon in the browser's address bar to set up site-specific trust. Or, if you don't mind using a slight variant, you can do your best to mimic NoScript-like control using the NotScripts add-on.

Other extensions and add-ons worth wielding to fight the malware fight include Web of Trust, KB SSL Enforcer, Adblock, and HTTPS Everywhere.

Firefox's NoScript add-on is an excellent tool for preventing page plugins from running on untrusted sites.



Google Chrome uses a sandbox to better protect you from web attacks. And based on the limited number of successful hacks over the years, it's worked!

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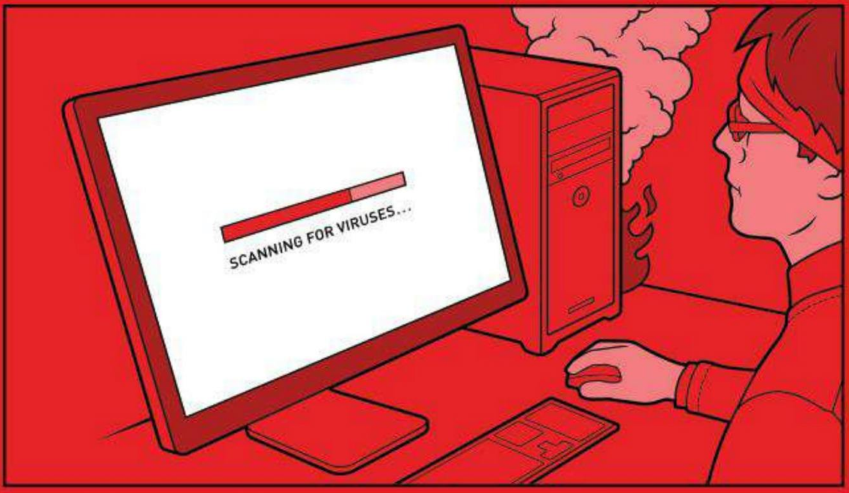
3 Use Software Safeguards



RUNNING A PERFECT browser setup only goes so far in the battle against malware: Remember, you are your own worst enemy. Assuming that malware could slip through the gates at some point, what are some of the free software tools you can use to equip your system with powerful protection before a rogue app gets out of hand?

First up, you'll want a comprehensive scanner running day in and day out to make sure that each and every bit of software you slap onto your computer gets a quick check. For that, we turn to none other than Microsoft's own Security Essentials app (bit.ly/f0WWra). Our reasons are simple: It's free and it works. Is it as comprehensive as a premium paid solution? No, but our rationale here is that it's better to have free AV that has updated definitions than a paid AV suite with a lapsed subscription.

Install Security Essentials and you'll get instant access to frequent Microsoft virus and spyware updates, in addition to a real-time scanning mechanism that protects your system from anything you download from the Internet (or, if you're fancy, anything on a USB device from the moment it's jacked into your system). MSE schedules nightly scans to run by default, but feel free to reschedule these for any time that suits you. Additional options let you set the exact parameters for when the scanning should start, which include the ability to restrict virus and malware hunts to periods when your CPU use is below a certain threshold.

Some of the very best antimalware apps on the market can be had for free, but with an asterisk: We're talking, of course, about SuperAntiSpyware (www.superantispyware.com) and Malwarebytes' Anti-Malware (www.malwarebytes.org). We're fans of Malwarebytes' offering, mainly because the freeware version of its powerful antispyware app gives you a few more features to tinker with than SuperAntiSpyware's. The hitch with both? No real-time protection, so make sure you set a mental task for yourself to run these apps on a daily or weekly basis.

If you want to get truly hardcore, be sure to grab ComboFix (www.combofix.org), as well. This app, often considered the "nuke it from orbit" option for certain nefarious bits of malware, uses the Windows Recovery Console to find and eliminate annoying malware. It doesn't protect your system up front, but it's a great tool to have in your back pocket when disaster strikes.

EXTREME PRECAUTIONS

So you're paranoid. We get it. There's nothing wrong with wanting even stronger security measures than those we've mentioned in this article. For the best-in-class prevention against debilitating malware and viruses, you have two options: a virtual machine or a "live CD."

A virtual machine is exactly what it sounds like: a pseudo operating system that runs within your existing operating system. Think *Inception*. Anything that happens to your OS-inside-an-OS cannot break out of the dream. Applications, malware, drive formats, you name it: That which transpires within the virtual machine's operating system will never affect your actual operating system running one layer above it. Beware, though: Some malware can tell if it's running on a VM and won't activate if it is. This can make compromised software seem harmless, and could get you to lower your guard and install it on your real machine, where the malware will activate.

Our recommendation? Check out VirtualBox (www.virtualbox.org), a totally free VM that lets you install any Windows version you want.

You can also super-protect your primary system (or browsing experience) by running your actions off a live CD. A live CD is typically a version of the Linux operating system that's been installed on a physical disc or USB key. Restart your computer and boot off a live CD, and you'll find yourself within a self-contained OS that's free of malware and other problems the second you boot. Once you're finished, presto: Your changes can disappear and you'll be back to a brand-new version of the OS to boot into the next time you need it.

Our recommendation? Check out Xubuntu (www.xubuntu.org). It's not as graphically interesting as other Linux "buntus," but it does give you a bit more flexibility for running the operating system on lesser systems—like those with anywhere from 256 to 512 megabytes of RAM.

4 Recover from Disaster

SO YOU'RE INFECTED. Shucks. Malware comes in different forms and annoyance levels, depending on just how well the particular piece of offending software has entangled itself into your operating system. This makes it difficult for us to deliver a fix that fits every situation. However, we can at least give you a few helpful suggestions for freeing your PC from malware's clutches.

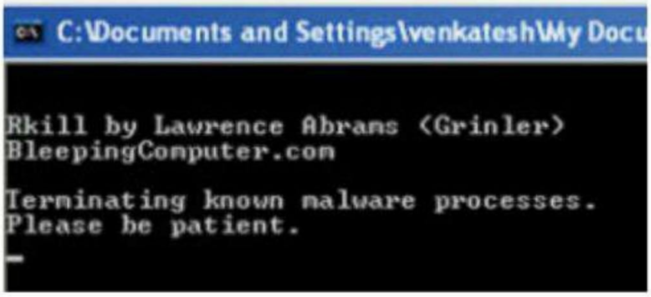
First off, see if a simple scan from Windows Security Essentials stops your issue dead in its tracks—likely not, but it never hurts to try the simplest solution before you start rolling up your sleeves a bit more. Update your definitions and select the full-scan option, and then sit back and hope that Microsoft's scanner can fix your problem. No luck? Next, fire up Malwarebytes' Anti-Malware, make sure your definitions are updated, and run a full scan on your system. If it catches an issue, great; if not, and your malware problem persists, it's time to get a little more creative. Fire up the utility RKill (www.bleepingcomputer.com), and use it to try to force-stop any malware processes that happen to be running in your system's background. Run a full scan with Malwareybytes' Anti-Malware one more time.

If you're still out of luck, you'll want to reboot your system into safe mode (keep pressing F8 as the BIOS loads until you're given the option for safe mode) and repeat the same RKill/Malwarebytes' Anti-Malware step as before. You're doing this in an attempt to unhook whatever malware's plaguing your PC from the operating system itself: It's not getting wiped out because it's still active (and possibly protecting itself from your removal tools).

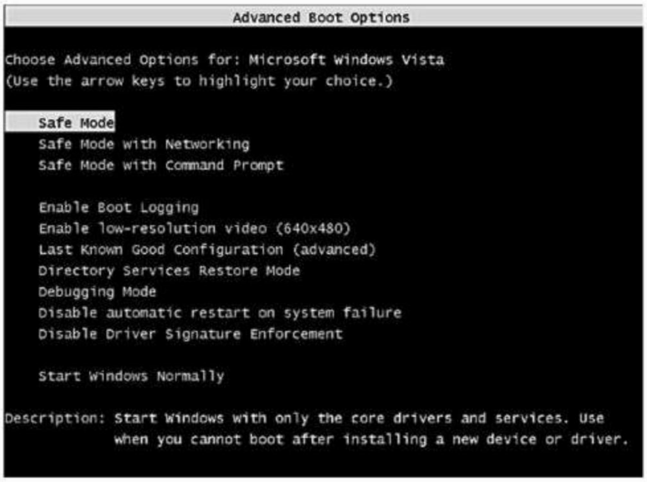
Still hurting? Fire up ComboFix and let the scanning and removal tool work its magic—if, for some reason, it can't remove whatever's affecting your system, you'll get a lengthy log that you can post on one of ComboFix's associated web forums for further assistance from qualified log parsers. At this point, it might be worth your while to check out other scanning tools not explicitly mentioned in this article, which range from Spybot Search&Destroy (www.safer-networking.org), to McAfee Labs Stinger (bit.ly/fLQZGQ), to GMER (www.gmer.net), to Sophos Anti-Rootkit (www.sophos.com), and the list goes on. And you might also benefit from grabbing a few live CDs, like AVG's Rescue CD (bit.ly/duJ0qW) or Hiren's BootCD (bit.ly/atD4Cz), for malware and virus removal.

There are nearly as many tools for removing malware as there is malware to infect you. The better you can protect your PC up front, including training yourself to recognize potential malware when it presents itself and keeping it off your system to begin with, the less you'll have to fool with potentially complicated removal techniques later.

But if you have to go down this route, and simple scans aren't getting the job done, don't forget to try ripping active malware processes out of your operating system and booting your PC into safe mode. After that, exorcising these software demons from your system is all up to your tenacity, your search engine research skills, and your knowledge of third-party removal apps—Or, if worse comes to worst, your backup schedule. You know, a clean install is but a few clicks away!



RKill is an excellent tool for detaching malware that won't stop running on your system: If it's running, it's not getting deleted by your antimalware apps.



Booting a system into safe mode is a useful technique to prevent malware from starting—and to ensure that your antimalware apps catch it.

GET THE BEST OF THE CLOUD

BY JAMIE MIDDLETON

WHICH COMPANY HAS THE ONLINE SERVICES AND CONTENT THAT ARE RIGHT FOR YOU?

Cloud computing is no longer the future—it's here. As if you need to be told that! Chances are, you already use web-based email; store some or all of your music, photos, or videos online; and stream movies and TV shows to your living room straight from the Internet. Indeed, we are slowly being encouraged to store less and less of our content on our own hard drives, and instead entrust it to the servers of a few corporate giants. Whether you're uploading photos and movies to Facebook, videos to YouTube, saving and sharing work in Google Docs, downloading music using your iTunes account, or reading books using your Kindle, your details and data are mainly held in the cloud, and it's a trend that's picking up steam. It's going to affect you in other ways, too, as more and more companies—and even government entities—are considering the use of cloud computing to provide the hosting and compute power for their services. Using the cloud is often cheaper, more adaptable, and, surprisingly, more reliable than running their own servers.

There's probably no other area right now where the cloud's potential is more evident than in entertainment. This year has seen many companies competing to offer cloud services to buy, store, and stream your entertainment collections. You aren't just backing up your content to the cloud—you often haven't downloaded it at all. With all your music, films, and books stored on a cloud server, you can stream them to your Internet-connected devices—all you need is a browser to access your entertainment services wherever you are.

So which company should you turn to for your cloud computing services? To whom should you entrust your beloved music, video, and book collections? And what else are these companies planning that will make your life more secure, easier, and stress-free in the future? We've taken a close look at four major players in the burgeoning field of personal cloud services—Amazon, Microsoft, Apple, and Google—to find out which one is right for you, or will be soon.

GOOGLE GOES THE DISTANCE

No other company has embraced cloud computing to the same degree

Samsung's original Series 5 Chromebook didn't make a big splash, but a second gen of browser-based Chromebooks is on the way.

GOOGLE'S OFT-STATED MISSION is "to organize the world's information and make it universally accessible and useful," and what better way to do this than by putting everything online? But nowadays Google isn't just about information—it's also about applications that can store, display, and manipulate that information in useful ways.

Google has been moving everyone onto its cloud web servers for years. If you use Gmail, Google Docs, Google Calendar, Picasa, or YouTube, you are already putting your data onto its cloud servers. With only a login between you and your content on any Internet-connected device, Google can truly lay claim to not only seeing the future of computing as web-based, but actually making it happen.

Google makes no bones about this. The company's approach is summed up by Robert Whiteside, head of Google Enterprise UK, Ireland, and Benelux: "Google is taking a '100 percent web' approach to all our services and solutions, meaning we believe applications will be browser based and hosted in the cloud, rather than in a desktop environment."

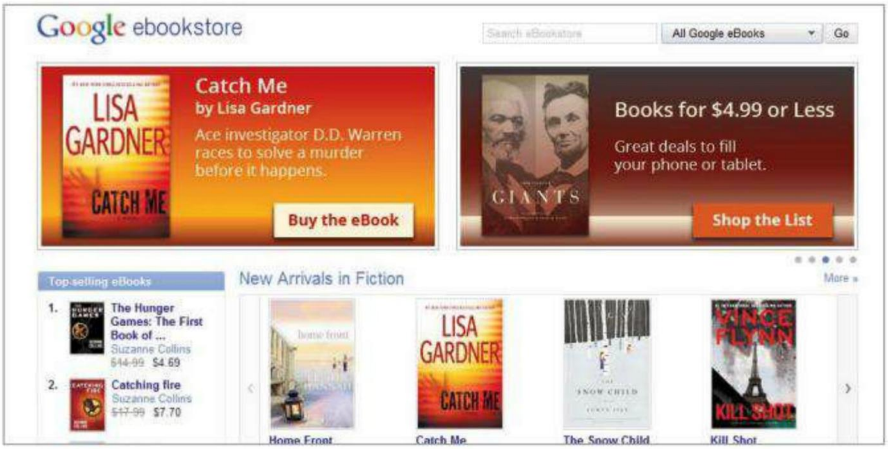
Google's cloud computing is already a success. As Whiteside is keen to point out, "Over 4 million organizations use Google Apps, our flagship cloud product." And that number is increasing by 5,000 companies every day (up from 3,000 a day last year). Google is even stealing the march on companies targeting businesses, with cloud-based collaborative office products that even Microsoft can't match.

Cloud, What Cloud?

Google has been very good at getting ordinary people to use cloud computing without them thinking of it as such. Most people accept the usefulness of Gmail and Google Calendar without worrying that the data contained on these services is saved in one of Google's server farms dotted around the world. Google is so reliable (it has a non-failure rate of 99.948 percent—approximately a mere seven minutes of downtime a month) that people don't even think about backing up their emails or Google Docs to their PCs.

Most companies see the cloud as a backup solution, but Google was one of the first to see further than that. In 2009, Google Docs came out of beta and allowed anyone to create documents in the cloud via a web browser for free. When Google Docs first appeared it was clunky and felt half finished, but now the documents it produces are customizable, shareable, and available to numerous people for editing in real time—perfect for a work or collaborative project scenario. Google has blazed a trail that has left companies like Microsoft desperate to catch up.

It isn't all altruistic, of course. The more



Google sells ebooks from all the top publishers and offers digital editions of millions of public domain titles for free.

THE QUIET CHROMEBOOK REVOLUTION

GOOGLE'S CLOUD COMPUTER IS A SLOW STARTER, BUT IT COULD BE THE FUTURE

If there's ever any doubt which company is the true champion of cloud computing, Google need only hold up a Chromebook running Chrome OS. It's the only company to produce a computer with an operating system that gets almost all its functionality from the Internet. For the Chromebook, Google teamed up with Acer and Samsung to produce low-powered netbooks that, when switched on, are essentially full-screen web browsers that only run web apps. It really is a revolutionary idea—so much so that when the devices were first released, Sergey Brin hailed Chromebooks as a "new model of computing."

Chromebooks have only minimal local storage, so you can't install programs like Microsoft Outlook, Word, or Adobe Photoshop. But, Google argues, why would you need to when you can, and probably already do, use online programs with these functions for your day-to-day needs? Web apps will let you create documents and spreadsheet, edit pictures, and watch movies—all you need is an Internet connection. The simple nature of the Chromebook makes it very fast to turn on, too —in a mere eight seconds you'll be ready to surf the Internet.

We've seen this before, of course. This is the idea of the thin-client: an underpowered computer you could take from workstation to workstation in an office so you can work anywhere, with office servers providing the processing grunt as opposed to the devices themselves. However, here the Internet provides the connection to the servers, making the whole world your office.

Still, the Chromebook's uptake has been very limited. It could be that the world, and the Internet, isn't ready for solely web-connected devices. There are other issues, too. The price of the Chromebook isn't that much lower than a normal netbook, and normal netbooks have the advantage of being able to run all the web apps a Chromebook can, but also let you install other programs onto it. The fact that you always need an Internet connection could also be severely limiting in certain situations.

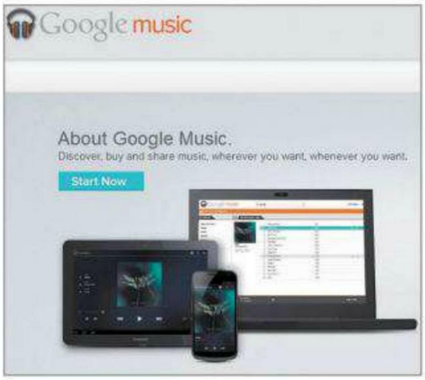
But as working in the cloud becomes more prevalent, so too could the Chromebook. Updates to Chrome OS can be automatically added to the Chromebook via the Internet, ensuring you have the latest version of the OS at all times. As Sergey Brin said at the Chromebook's launch, "Ultimately the most precious resource is the user's time. I think the complexity of managing your computer is really torturing users." The fact that most of the processing is done in the cloud extends the battery life to 8.5 hours, and if you lose your Chromebook, all your data, photos, and files are still merely a login away.

eyes Google gets looking at its web apps as opposed to desktop programs, the more money it can make. Hence the fact that Google has made so many cloud-based apps. The company is adding to the list all the time; for example, there are Google Maps, Google Mail, Google Earth, Google Docs, Google Blogger, Google Site Manager, Google Contacts, and the business offering Google Apps. All these fill a niche, and often provide a free solution, whereas before you would have had to buy a program or do without.

The downside to this is that Google also has a record of letting its less popular services dwindle away. These include Google Wave, Google Buzz, Google Labs, Google Health, and Google Powermeter. This may seem like a sensible move if few people are using them, but it no doubt alienates those who do.

Content Is Key

Google knows that to keep people coming back, it needs to give them access to cloud-based entertainment as well as services—hence new additions like Google Books, Google Music, and the video rentals now available from the Android market and YouTube. Google has always dabbled with content—its ownership of YouTube and Picasa attests to that, as do its projects that aim to digitize books that are out of print and out of copyright, but now it wants you to rent or buy directly from Google, while still keeping the products in the cloud.



The Google Music cloud streaming-music service directly competes with Amazon Music and Apple's iTunes.

With Google Books, the company has made hundreds of thousands of ebooks from the world's largest publishers available for sale online, as well as more than 2 million public domain ebooks for free. These books are then stored in the cloud and accessible via any web browser. A video rental app available through the Android Market lets you rent any of thousands of movies and watch them in any browser at any time within 30 days of purchase, with a 24-hour active period once you hit play. A similar service is available from YouTube.

Google Music (available only in the U.S.) lets you buy from a list of 13 million songs. You can also upload up to 20,000 songs to its online library, and the service will automatically upload any music you add to your computer's music folders. This means you can then play these songs from any device with an Internet connection—you can access your music wherever you go. This service is free, whereas Amazon and Apple charge an annual fee to store music not bought in their stores.

The future is the cloud, and Google has the infrastructure, the money to spend on research, and the vision to ensure it continues providing free apps that are game-changing. It's not only keeping up with the trends in cloud computing, with free and paid-for entertainment, it's ahead of the curve, producing products like Chrome OS that rely solely on the web for their functionality. Google is clearly the one to watch for the future of the cloud, and with Microsoft, Apple, and Amazon following it closely, the need to keep innovating will ensure that Google keeps producing services and content with the potential to forever change how you use your computer.

APPLE'S ANSWER

iCloud is nice—if you're strictly devoted to Apple products

BEFORE STEVE JOBS DIED, he made a very strong statement at the Worldwide Developers Conference keynote in San Francisco. "We're going to demote the PC and the Mac to just being devices," he said. "We're going to move your hub, the centre of your digital life, into the cloud." He was talking about the introduction of iCloud, a service that will automatically update all your Apple documents and iTunes purchases across your suite of Apple devices. Download a track from iTunes on your iPhone and it will be waiting for you on your Mac. Take a picture on your phone and you can show people the result almost instantly on your iPad. Start a presentation in Keynote at home and it will be waiting on your Mac at work. It uses the almost-always-connected nature of these devices in an integrated way. As Jobs said, "Today it's a real hassle and very frustrating to keep all your information and content up to date across your devices. iCloud keeps your important information and content up to date across all your devices. All of this happens automatically and wirelessly, and because it's integrated into your apps you don't even need to think about it—it just works."

There should, however, have been a caveat to this. He was only talking about iOS devices—iOS 5 specifically. Poor old iOS 4 and Snow Leopard users aren't part of Apple's new iCloud gang, and neither are those who don't use Apple's software on their PCs. Apple has always enjoyed ring-fencing its content to its own software and devices, and the iCloud experience is only for the iTunes set. If you have an Android phone, you won't be using these new services any time soon. Similarly, although you can get iCloud support for iTunes on your PC, this isn't the same as just logging in to a browser-based version. You won't be able to listen to your music at work if your IT department won't let you install iTunes on your office desktop machine, for example.

Apple-only Documents

iCloud isn't like Amazon Cloud Drive, Dropbox, or SugarSync, which will let you back up anything. Only files created by iCloud-supporting applications will be synchronized to all your devices. Neither is iCloud as free and easy as other cloud storage apps, which usually offer browser versions that let you download any of your files by logging in to a website. Although there's a website for Apple's service at **www.icloud.com**, this just lets you see your mail, contacts, and calendars. You can't stream your entertainment content from the site—it's more of a backup for when things go wrong, giving you access to Apple's Find My iPhone service or merely letting you use the site to upload documents created on iCloud-enabled apps like Pages, Numbers, and Keynote but not edit them online.

Of course, if you only use the latest Apple devices, these issues won't worry you and iCloud will be a fantastic free extra that puts the cloud to work for you. Some of the services are really fun and useful. Take Photostream, for example, the newest version of which takes the last 1,000 photos from your Apple device, saves them online for you to see on iCloud, and downloads them to all your devices when you switch them on. iCloud will also let you pause supported games on your iPad and then continue them later on your iPhone.

The free 5GB of iCloud storage for mail, documents, and other backups isn't to be sneezed at, although it's not as generous as some other companies' offerings.

That said, this limit isn't affected by any content bought from iTunes, so your Apple-bought music, apps, and books are stored separately. Photostream photos don't count toward this 5GB, so the offer is more generous than it first seems.

Your Music in the Cloud

iTunes in the Cloud lets you redownload previously purchased content on to your newer gadgets at no additional cost, so everything you've bought is available on all your devices.

iTunes Match will scan your entire iTunes library and replace each song not bought via

iCloud lets you access anything you've bought on iTunes from any of your Apple iOS 5 devices.

With iTunes in the Cloud, you can redownload previously bought content.

iTunes (music you have ripped from a CD, for example)—even low bitrate versions—with 256Kb/s, DRM-free AAC versions. These can then be downloaded or streamed to all your other iOS 5 products, basically putting your entire music library onto all your Apple devices. iTunes Match is a subscription service. Unlike Google Music, which is free, Apple charges $25 annually to upload and store music not purchased through iTunes. On the other hand, it's a very fast service compared with Amazon and Google's offerings—backing up your entire collection will take hours rather than days. No song is excluded, either; you can manually upload any song not listed in the 20 million–strong iTunes library.

Another unusual thing about iTunes Match is that Apple has obtained permission for the service from all the major music labels. Google and Amazon have gone for a more "suck it and see" approach, describing their services as hard drives in the cloud and not seeking permission for the content—or only striking deals with some labels. Google and Amazon argue that the tunes are just data, but it could be said that Apple is on a more sound legal footing. It wouldn't be fun to upload your collection to Google or Amazon and then have access denied due to a legal ruling.

The Death of MobileMe

It's no secret that Apple has a poor record when it comes to cloud computing. iCloud started as iTools in 2000, and became a much-mocked subscription service called MobileMe in 2008. MobileMe is now being discontinued, to the chagrin of some dedicated users, with subscribers being transferred to iCloud. They are gaining all its new services, but losing some older MobileMe-only ones like the Gallery, iDisk, and iWeb publishing services.

Although iCloud is a revolution compared to these earlier offerings, Apple still isn't exploiting the full power of cloud computing. For Apple it's all about the content—movies, TV, books, and music. Microsoft and Google are all about online collaborative services, where people use the cloud not just for synching, but for shared document creation online, while Apple has stuck to using it for content delivery. The cloud means you no longer have to plug your iPad into your Mac to update it—it happens automatically and out of sight. This is admirable, but leaves a big hole in its functionality. Where are the online versions of Pages, Notes, and Numbers? Why can't people collaborate on these programs using the cloud? Anyone who needs this kind of service has to go to another company for it, and that may yet be to the detriment of Apple.

In fact, it's already starting to show—Microsoft boasted that in November 2011, Hotmail was being used on 2 million iOS 5 devices, and was growing by 100K users per day. This may change once the full impact of iCloud is felt, or may be due to legacy use as more people switch to Apple from Microsoft devices, but Apple should be worried that people are sticking to its competitors' services.

A Restricted Hard Drive

At the iCloud launch, Steve Jobs noted that "a lot of people think the cloud is just a hard drive in the sky." Clearly a lot of people do, and with iCloud, Apple has challenged this idea by using the service to store Apple-only documents. Integration is key to true cloud computing; no one company can provide everything you want to do on a computing device. There has to be an opening for other companies' technologies, or people start to look elsewhere for a less restrictive service.

This is a common complaint leveled at Apple. The cynical see iCloud as just another way to encourage people to buy more Apple devices, but is that really any different from the restrictions demonstrated by Amazon's Kindle Fire, or the bundling of all of Google's services from your Google home page? Admittedly, the limits are a lot more delineated with iCloud, but if you have more than one iOS 5 device, there is little doubt that the convenience offered by iCloud and its associated services will be very attractive. If you only use Apple hardware and software, iCloud will give you everything you need.

WHAT WILL ITV BE?

EXPECT VOICE AND GESTURE-CONTROLLED CLOUD-BASED ENTERTAINMENT

Rumors about a new smart TV from Apple began flying after a mention of it appeared in Steve Jobs's biography. He reportedly told his biographer, "I'd like to create an integrated television set that is completely easy to use. It would be seamlessly synched with all of your devices and with iCloud. It will have the simplest user interface you could imagine. I finally cracked it."

It's no secret that Apple wants to repeat its success with music players, phones, and tablets. Television is the last screen-based medium it has to tackle, but the company has always said that in order for TV to work the way Apple wants, it would have to be re-created from the bottom up. There are hints that such an undertaking is underway, with some reports claiming that Apple has already started the manufacturing process for the screens, and that a TV could appear as early as 2012.

The rumor mill has it that the "iTV" will be voice-controlled, no doubt using Siri-like technology, letting you change channels, move through an image gallery, and access functions like answering phone calls and editing videos. There's also evidence that it may be gesture-controlled, revealed in an Apple patent detailing a "real-time video process control using gestures."

An Apple TV device already exists—a tiny cloud-based box released four years ago, which Apple described as "an easy-to-use and fun way to wirelessly play all your favorite iTunes content from your Mac or PC on your widescreen TV, including movies, TV shows, music, photos, and podcasts." It never really caught on, but if Apple can create a simple and elegant TV to match the iPhone and iPad, its customers will never need to use anything else, leaving the company in a very strong position, indeed.

With Microsoft's Live Mesh, you can sync changes to files and folders across multiple machines.

MICROSOFT MAKES UP GROUND

It's got the business and personal cloud apps, but is it doing enough with entertainment?

MICROSOFT HAS A HISTORY of leading the field with cloud services, having launched MSN Messenger back in 1999 and Hotmail in 1997. Back then, getting a service like email for free was surprising, and for the average person, the ability to access email from any Internet-connected computer was groundbreaking. In fact, because of this, Hotmail was launched on July 4, Independence Day, to highlight the fact that it offered you independence from ISP-based email.

Those days are long past, and Microsoft has spent years playing catch-up with other cloud services, like those offered by Google. Microsoft originally dismissed the likes of Google Docs as nothing to worry about, but that is clearly not the case. Microsoft has stepped up its game in the last few years and may yet be a cloud computing force to be reckoned with.

Being last to the party isn't always a bad thing, especially if you happen to own the suite of office applications used by most of the world. Google may have made inroads into that audience, but people have trusted Microsoft with their office documents for decades. All Microsoft needs to do is offer the functionality that makes Google Docs so attractive, but designed to look like a trusted product.

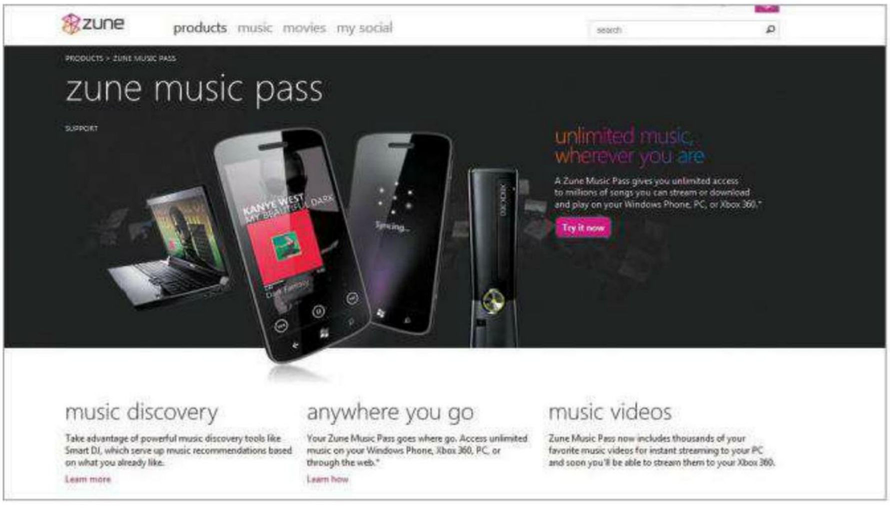
Office Online

This is where the paid-for versions of Microsoft 365 and the free personal consumer service SkyDrive with Web Apps come in. Microsoft 365, launched in June 2011, is the latest version of the clumsily named Business Productivity Online Suite (BPOS). It's a subscription-based online version of Microsoft Office, offering online collaboration and document sharing for businesses. Microsoft 365 is Microsoft's answer to Google Apps, albeit a more expensive one. There aren't a lot of figures available for its uptake yet, but in November 2011, Office division chief Kurt DelBene said, "We are seeing positive momentum for Office 365. Customers are adopting Office 365 eight times faster than our previous service, and it's on track to become one of the fastest growing offers in Microsoft's history."

Of more interest to the ordinary user are SkyDrive and Live Mesh. SkyDrive has been around since 2007, and offers 25GB of free online storage via Windows Live. It also lets you use Web Apps—cut-down versions of tools like Excel and Word—to collaborate online with others in the creation of Office documents. However, Web Apps don't offer the real-time collaboration that Google Apps do. For example, you won't see characters on the screen as people type them; instead you're frozen out of the piece of the document where someone is typing, and you can only see those changes once that person hits save and you refresh your screen.

But the actual look of Web Apps is one most of us are used to seeing in Office. It takes a lot of effort for people to learn new icons and new styles, so Microsoft still has the upper hand, at least in the familiarity of its product.

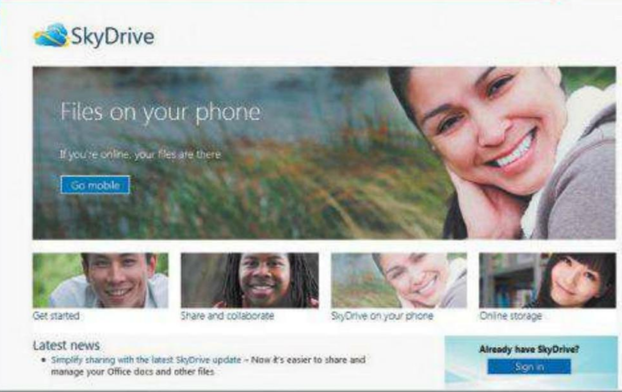
Live Mesh is a handy free service that lets you sync your files across multiple PCs and locations. Just download the Live Mesh client onto each PC you use, assign the folder you want to sync, and whatever changes you make to documents in that folder will be automatically synched to your SkyDrive and to the other PCs in your "mesh" when they are switched on.



Zune Music Pass lets you stream music and music videos to devices like Windows Phone 7 phones, Xbox 360s, PCs, and Zune MP3 players.

THE FUTURE OF SKYDRIVE

SKYDRIVE FUNCTIONALITY IS BEING BUILT INTO WIN 8, AND MAY BECOME PLATFORM AGNOSTIC



There are big changes in store for SkyDrive, but can Microsoft do enough to make it more attractive than its competitors' offerings?

Microsoft is determined to make cloud computing work with the development of SkyDrive, its online storage service. This is probably because it is planning to integrate SkyDrive functionality into Windows 8, in much the same way Apple has integrated iCloud into iOS 5. We know SkyDrive will be an important element of Office 2013. Microsoft has been working hard to get SkyDrive ready in time. "SkyDrive has been around since 2007, and was simply not built for the modern web," said group program manager Omar Shahine on the Windows blog in June 2011. "Browser modernization has really opened up the window for us to rethink and re-architect how we build our websites."

Shahine sees SkyDrive as a "file cloud," or put another way, "a file-centric view of cloud storage presenting your information to you in a traditional file- and folder-based metaphor." Basically, this means it looks like a normal file browser, but online. Shahine wants to use all the latest web tools to make SkyDrive's user interface as functional as possible yet still pretty, to mirror the look of a typical Windows application.

To achieve this, Microsoft has reinvented SkyDrive using HTML5 and CSS3, providing an interface not usually present in cloud services. "We took advantage of modern browsers and HTML5 to make SkyDrive faster, easier to navigate, and more beautiful for viewing photos," said Shahine. "We got the chrome out of the way to let your photos fill the browser. We added tasteful animation using CSS3 that brings photos to life and presents them in their original aspect ratio, and with the new best-fit grid your pictures are laid out so you can see them all, even panoramas." Microsoft has even done away with the advertising pane to allow more file information to be seen by the user.

Other functionality has been added, too, so you can pin SkyDrive to your IE9 taskbar, giving you access to its contents from the browser. You can also save documents to your SkyDrive directly from Office 2010.

Perhaps most exciting is what Microsoft has planned for SkyDrive in the future. In addition to the 25GB of free online storage (a move that mirrors Apple's iCloud offering), there are rumors that Microsoft is on the cusp of offering unlimited capacity on SkyDrive for your photos and Office documents. A Microsoft job posting also hints at SkyDrive and its products soon being available outside the Microsoft fold. If the description of the developer post is anything to go by, apps may be developed for SkyDrive clients for Windows, iOS, and Android. This may mean that Microsoft is finally understanding that non-device-specific sharing and streaming is what true cloud computing should be all about.

Despite these steps, SkyDrive still has a way to go before people will be totally happy with it, especially when store-and-sync online services like Dropbox and SugarSync don't have any of SkyDrive's problems, such as limits on the number of files you can move or delete at a time, or the 100MB size limit on files when you are meant to have 25GB to play with. However, with Microsoft and the product development team behind the service making the right noises, it may well be one to watch in the future.

All Work and No Play

Increasingly, Microsoft is being seen as the business side of cloud computing, but if Apple and Google let you work as well as play, Microsoft could soon find itself left behind. Not that it doesn't have entertainment-streaming cloud services—Zune Pass is a cloud-based evolution of Microsoft's Zune media players, which were designed as the company's answer to the iPod. It's a subscription-based service that lets you stream music and music videos to devices like Windows Phone 7 handsets, Xbox 360 consoles, Windows PCs, and Zune MP3 players. It lets you download TV programs and rent videos, too.

At Zune's launch in 2010, Craig Eisler, corporate vice president of Microsoft's Interactive Entertainment Business Group said, "The integration between Zune, Windows Phone 7, and Xbox Live is an exciting advance in our entertainment offering. Zune enables users access to the entertainment they want, wherever they want it—and now, more people than ever will be able to enjoy the freedom and flexibility that the Zune service offers."

Well, not quite wherever they want it. Zune can only be used on four Microsoft devices and doesn't support Android or iOS. Although there is an online version of the service at **www.zune.net**, it doesn't work in a web browser—you need to be on a machine with the software installed. It's expensive too, costing $9.99 a month for the music streaming service, with an extra charge for TV and video rental.

Xbox Live without the Xbox

Microsoft has other online content available via Xbox Live, letting you watch movies and TV using your Xbox 360 or Windows Phone 7 handset. It hasn't taken these technologies fully into the cloud, but there are rumors that Xbox Live may be integrated into Windows 8. Speaking to the *Seattle Times*, Microsoft vice president Mike Delman said, "Live has been successful on the Windows Phone. Live will be built into the PC. It will be the service where you get your entertainment."

There are more developments coming for Xbox Live. According to some sources, Microsoft's developers are looking at services like OnLive, which prove that high-powered gaming can be delivered to mobile devices over the Internet, and may be planning something similar. As Microsoft cloud developer Brian Prince said at the GDC China conference, "You will be seeing things in the Xbox platform that are cloud-specific. I'm already doing it, it's really exciting, but I can't tell you about it or else I'll get fired."

So the future of cloud computing could be rosy for Microsoft, even if its present isn't much to shout about. We aren't writing off Redmond just yet, but we would probably look elsewhere for most of our cloud services at the moment.

THE AMAZON WAY

From retailer to cloud pioneer to major player in content streaming

Amazon's Kindle Fire puts all of the company's digital content within easy reach of consumers.

AMAZON HAS A STRONG track record in the sphere of cloud computing, and is rapidly expanding its online services in the U.S. No longer just an online shop, albeit a huge one, Amazon is diversifying into areas that could help you enjoy online services that are better than, on a par with, or totally unique from the biggest players in cloud computing. Today it's one of the largest providers of cloud services in the world, challenging the likes of Google and Apple, and even beating them to the punch by launching new services like its music-streaming Cloud Player. It's also championing a cloud-powered web browser called Silk, which uses Amazon's servers to load web pages so your device doesn't need to.

Amazon could easily own cloud computing in the future, in much the same way it has in the past. It was one of the first major companies to open up cloud computing to the masses more than nine years ago. This wasn't through cloud services like webmail or online document creation, but by renting out storage space and raw computing power. In 2002, with Amazon Web Services (AWS), the company opened up the power of its unused servers to companies and individuals. It made sense—why should the company pay for all the server space and processing power that wasn't being used when there was a desperate need for it by others?

Later it refined this offering with Amazon EC2 (Elastic Compute Cloud), which allowed anyone to rent Amazon's spare server capacity by the hour. This is a truly adaptable service that lets companies expand and contract to match demand for their services without having to pay for extra servers that may be redundant the following month. It's a flexible service that saves people money as customers are only charged for what they use, and its adaptability means businesses can grow in line with their needs without costly infrastructure investment. Despite concerns about storing private or business data in the cloud, EC2 has grown at an astonishing rate.

Cloud Outage

In fact, some people's fears about the reliability of the cloud were apparently realized in April 2011 when an Amazon outage closed many sites, including Foursquare, Reddit, and Quora, some of which were down for days. Amazon released this statement after the outage: "We know how critical our services are to our customers' businesses and we will do everything we can to learn from this event and use it to drive improvement across our services."

We're only in the first few years of the major uptake of cloud computing, so there are likely to be more teething pains, and there seems to be little you can do about them other than having a backup system of your own—which does seem to defeat the purpose of using cloud computing. Tellingly, no cloud computing firm currently offers insurance against lost data. Despite this, a global study carried out by IBM in 2011 found that more than 60 percent of organizations plan to "embrace cloud computing over the next five years."

But Amazon isn't all about business and web development. In 2011 it extended its cloud computing reach to include other, more personal services. It's catching up with (and even overtaking) the other big cloud players like Google and Apple by offering online video streaming through Instant Video, online book offerings through the Kindle, music streaming through its new Cloud Player, vetted apps through its Android app store, and personal online storage through its Cloud Drive service.

Amazon Is on Fire

The company has also released a modified Android tablet in the form of the Kindle Fire, which lets users store purchased media like books, films, music, and apps in the cloud, and access them on Amazon mobile devices. Amazon is cementing its journey from an online store to an entertainment destination. It has embraced this challenge in a big way, not only providing places for content to be streamed from, but even creating its own content—it has become a publisher of its own books.

This could change publishing forever, with fewer intermediate steps between author and reader. As top Amazon executive Russell Grandinetti told the UK *Times*, "The only necessary people in the publishing process now are the writer and

reader." With the release of Amazon Music Player in the U.S., there's speculation it may soon do the same with music.

Amazon is muscling in on the turf of Apple and Google, and it's going about it in a very competitive way. Amazon is so keen to get you using its cloud services to buy its online content that it's even willing to subsidize the cost of its device to get you using it. The Kindle Fire costs over $10 more to make than its $199 price tag. In much the same way that Sony and Microsoft subsidize their game consoles in the hope they will recoup their money on games and services, Amazon has brought out a very low-cost tablet that is so integrated with the shop's selection of books, music, and other content, you may never need another media provider.

Amazon's Cloud Drive gives account holders 5GB of free space to back up important files.

Let's Go to the Movies

Amazon's first foray into cloud entertainment was with Amazon Unbox in 2006, which allowed users to rent and purchase movies and television shows over the Internet. That service was later renamed Amazon Video on Demand in 2008, and now bears the moniker Amazon Instant Video. Amazon further upped its presence as a cloud entertainment provider when it began making free online streaming of select TV shows and movies part of its Amazon Prime subscription service. Prime initially offered members just free two-day shipping on Amazon.com purchases, but now throws in unlimited access to a growing catalog of digital video content, as well as the ability to borrow one free Kindle book a month. Prime members pay $79 a year, but as with the Kindle Fire, Amazon is incurring a loss, to the tune of $11 per member annually, according to a recent article on Time.com. So what does Amazon get in return? For one thing, it has helped Amazon's streaming service get noticed amid Netflix' near-total dominance—even more so after Netflix began charging its subscribers extra for streaming content, sending many of them looking for an alternative. As Netflix learned, but then forgot, the value-add of getting something extra for free is a powerful tool in building customer loyalty. Furthermore, once a customer is perusing Prime's library of free video content, they're a mere click away from the far more vast selection of TV and movies available through Amazon Instant Video proper, where content is available for sale or for rent. The situation in similar for the Kindle book loan.

Cloud Music

When it comes to streaming music from the cloud, Amazon was a surprise early adopter. It beat Google and Apple by releasing Cloud Player in March 2011. It's an impressive service, letting users back up pretty much their entire music collections to Amazon's servers. Users can then access it from computers and Android devices. As Amazon's vice president of music and movies Bill Carr said, "Our customers have told us they don't want to download music to their work computers or phones because they find it hard to move music to different devices. Now, whether at work, home, or on the go, customers can buy music from Amazon MP3, store it in the cloud, and play it anywhere."

Amazon account holders in the U.S. can get Cloud Player free with 5GB of storage, but if they buy an MP3 album from Amazon the storage allotment increases to 20GB. Music bought from Amazon doesn't count toward your storage limit.

So how does Amazon license the music stored on Cloud Player? Simple—it doesn't. As Amazon's director of music Craig Pape explained, "We don't need a license to store music. The functionality is the same as an external hard drive." Amazon's Cloud Drive was introduced at the same time as Cloud Player. It gives U.S.-based Amazon account holders 5GB of online space free, allowing them to back up their most important documents and photos to the cloud.

So is Amazon the future? There do seem to be gaps in its online offerings. For example, there are no email services or online apps for the creation of spreadsheets or documents. But when it comes to online content, it has most bases covered.

AMAZON SILK BROWSER

IT USES THE CLOUD FOR THE HEAVY LIFTING INVOLVED IN SURFING THE WEB

Cloud computing has the power to turn underpowered devices into lightning-fast PCs by doing the processing in the cloud and then displaying the results on your screen. This is already turning the world of gaming on its head with the introduction of Microsoft's OnLive, but now Amazon has applied it to web browsing. Released with the Kindle Fire, the Amazon Silk browser builds on a concept first seen in Opera—preloading the contents of commonly browsed pages on Amazon's servers to avoid putting strain on the device doing the browsing. Silk can also decide how much work to do for you. If it notices you're in an area of low Internet bandwidth, it will push more work onto Amazon's servers.

What's more, typically, when loading a web page containing numerous components like ads, videos, Flash, and so on, it takes a little while for the page to load, as each request for each service or process has to load before the next one can be dealt with. Because of the vast cloud computational power behind Amazon's browser, instead of waiting for one request on a web page to finish loading before starting the next, Amazon Silk can load all the processes simultaneously. It will also remember the experience of other users going to the same page, and will provide the end result of the process direct to you rather than reinitiating the process for your request.

There are concerns, however—when a company as large as Amazon is so closely monitoring the surfing habits of its users, it naturally raises questions about just what data the company will keep once it has a log of exactly what each user is looking at on the web every day, and in what ways that data will be used.

By Gordon Mah Ung and Nathan Edwards

OPERATION

OUR MISSION: TO OVERHAUL THREE REAL-WORLD PCs

The PC upgrade is, sadly, a lost art form today. Fifteen years ago, the vast majority of PC buyers bought machines with long-term plans to upgrade them as newer, more capable parts became available. Today, most people would rather just chuck an aged PC into an e-waste bin and buy a completely new computer. We say boo to that. A well-thought-out upgrade can be the most economical option, extending the life of your PC's still-useful parts—not to mention giving you a tremendous sense of satisfaction at your resourcefulness.

The trick is in knowing where and when an upgrade makes sense. Sometimes the lure of an upgrade can walk you down a path you never should have started on. For example, it may be tempting to buy that Core 2 QX9650 on eBay for $300, but you'd be much better off upgrading the CPU and motherboard to a Core i7 instead.

On the following pages we detail three distinct PC builds desperately in need of performance boosts. We walk you through our thought process in determining realistic upgrade goals for each PC and how and why we choose the parts to get there. Before and after benchmarks reveal the fruits of our labor.

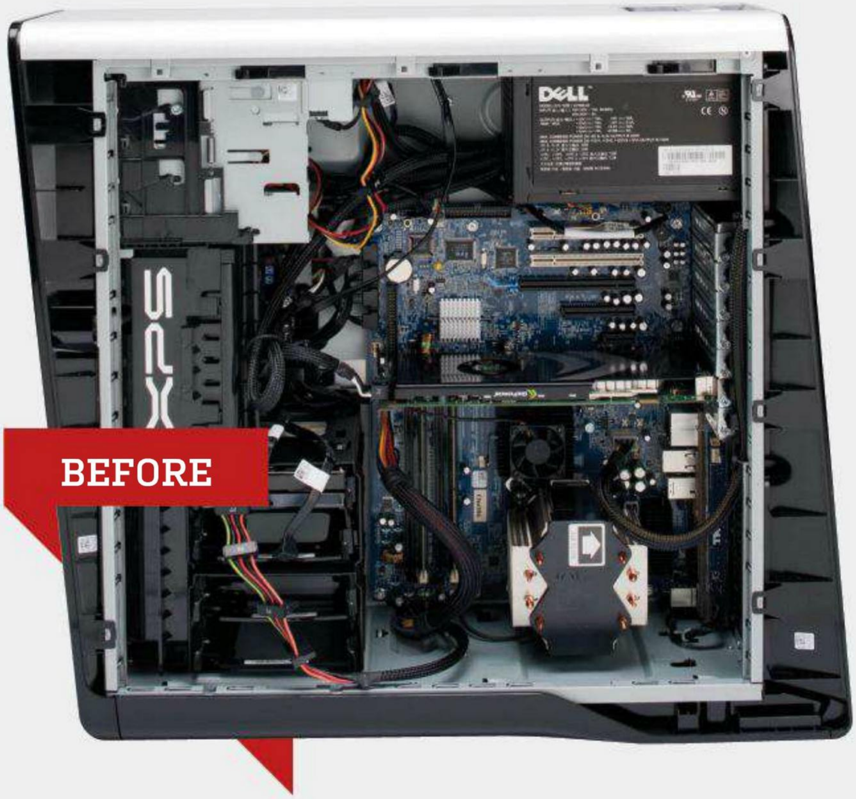
While these are just three case studies, let them serve as useful examples of sound upgrading practices that you can apply toward the resurrection of any elderly PC, within reason. The first step is always to thoroughly weigh the costs/benefits. Some PCs, after all, truly should be retired.

UPGRADE

WITH SMART, WORTHWHILE COMPONENT SWAPS

BECAUSE WE CAN

One of Dell's first PCs to eschew proprietary parts is just begging for an upgrade



ORIGINAL BUILD

CPU	2.66GHz Core 2 Quad Q6600
RAM	2GB DDR2/800
Motherboard	Custom Dell
GPU	GeForce 8800 GT
Cooler	Custom Dell
HDD	320GB 7,200rpm
ODD	NEC DVD burner
OS	32-bit Windows Vista
PSU	Dell 750 watt

The Dell XPS 630i was budget state-of-the-art in 2008, but is now in serious need of more performance.

THE MACHINE

Crank back the clock to 2008 and you get Dell's XPS 630i. A nicely outfitted gaming rig for its time, the XPS 630i sported a 2.66GHz Core 2 Quad Q6600, a GeForce 8800 GT, a 750-watt PSU, and—get this for a last-decade flashback—a Hitachi 320GB 7,200rpm HDD. In 2008, this was a decent machine in a very nice brushed-aluminum case for around $1,500. What made the XPS 630i particularly special was its use of off-the-shelf industry components. Dell has long been kicked around by the media for using proprietary power supplies and motherboards in its machines. Dell's defense has been that the changes were made to improve the specs. For example, Dell was one of the first consumer PC makers to use larger, server PSUs and plugs in its machines—a practice that bugged everyone, including us. Today those server power plugs aren't unusual at all, but a staple of ultra-high-performance machines, so it seems like Dell was on to something. But we digress.... More to the point: The XPS 630i was one of the first rigs in which Dell exorcised proprietary parts. It's industry standard all the way, or so the company said at the time. Well, baby, we're going to find out.

THE MISSION

Since the XPS 630i began its life as a budget gaming rig, we thought we'd keep the machine's mission the same, with upgrades that would transform it into a budget gaming rig fit for the modern day. Since we've always been fond of XPS 630i's case, we had no intentions of upgrading the enclosure—just pretty much everything else.

THE UPGRADES

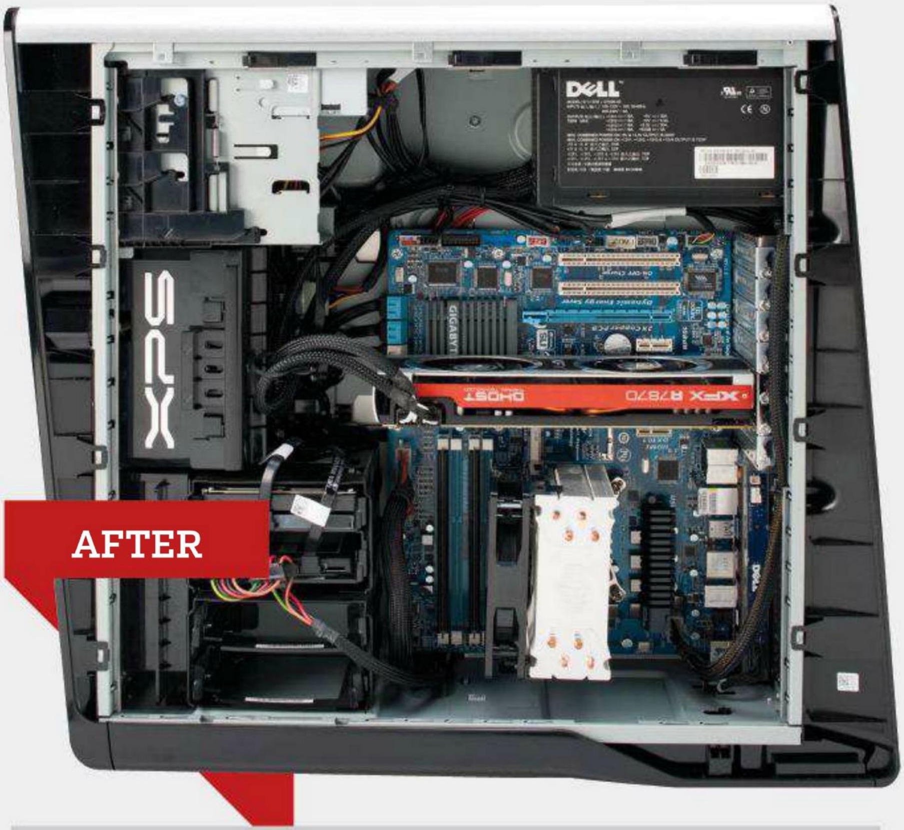
If you run old games or a browser all day, the classic Core 2 Quad Q6600 is plenty of computer—but we wanted more. We pondered a CPU upgrade for about five seconds, but the prices of older LGA775 chips and the performance it would yield didn't seem worth it, particularly since we didn't know if the board in the Dell would support higher FSB chips or even 45nm parts.

BENCHMARKS

	PRE-UPGRADE	
Vegas Pro (sec)	WNR	3,021 (N/A)
Lightroom 2.6 (sec)	1,224	343 (+257)
ProShow 4 (sec)	2,442	868 (+181)
MainConcept 1.6 (sec)	5,580	2,009 (+178)
STALKER: CoP (fps)	WNR	47.4 (N/A)
Far Cry 2 (fps)	25.9	107.3 (+314)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

The Dell XPS 630i was surprisingly easy to upgrade and exceeded our expectations in performance.



We next considered an X79 board paired with a 3.6GHz Core i7-3820, but most X79 boards are simply too wide for this chassis. We also had to mind the Intel-style front-panel connector, which rules out any Asus board without doing some wiring surgery. Then we remembered the internals from our May 2012 "Build a PC on Any Budget" story. The Sweet Spot PC and its Core i5-2500K part seemed perfect for this upgrade. Yes, Ivy Bridge would have been nice, but we simply didn't have access to the budget IVB parts yet. Since the Sweet Spot indeed seemed like the sweet spot, we figured we could just migrate all the internals over to the XPS 630i. Well, almost all of them. We hit a problem with our GeForce GTX 560 Ti 448 card. It requires an 8-pin PCIe plug, and the Dell only gave us two 6-pin units, so we opted for a slightly pricier XFX Radeon HD 7870 card instead. It's faster than the 560 Ti 448 card. Another option would have been to spring for a GeForce GTX 680, but that seemed to break our budget mantra. The machine originally came with the 32-bit flavor of Windows Vista Home Premium, so that was ejected for 64-bit Windows 7 Home Premium. The 320GB hard drive was dismissed from its boot duties in favor of a 120GB OCZ Vertex 3 drive.

THE RESULT

We've always wondered if Dell was true to its word when it pledged that the XPS line used industry-standard parts. Our experience here shows that Dell wasn't fibbing, provided you stick with a narrow board that uses a standard Intel-style FP connector. The Gigabyte GA-Z68XP-UD3 fit like a glove. The only sticky part was that the front USB and FireWire connector cables were too short. There are two ways to overcome this: $5 extension cables or a $20 NZXT internal USB expansion. We opted for the latter. You'll also need to pick up a $5 internal cable for the front FireWire port if you plan to use it; we just left it disconnected since the board has a rear FireWire port, too. The original 320GB drive gets erased and reused for storage to keep costs down. It's easy enough to swap in a 1TB or 2TB drive, though.

The performance difference was like night and day. If you're idling a Core 2-class machine today and wondering if you really need to upgrade, we say *hell yes* (unless you get paid by the hour and want things to go slower.) The 4GHz Core i5-2500K smokes the 2.66GHz Core 2 Quad Q6600 part in everything we could run. And believe us, some apps would not run, such as Sony Vegas 9, which gave us "out of memory" errors in 32-bit Vista. In Lightroom, we saw a 257 percent improvement; in ProShow Producer 4 we saw a 181 percent boost; and in MainConcept the difference was 178 percent. Even in general use, it was hard to believe how far we've come in just a few years. Thanks to the SSD, our boots went from two-minute affairs to 30-second ones. In the end, we're declaring mission accomplished, because this old dog now sings.

UPGRADES

	PART	URL	PRICE
CPU	Intel 3.3GHz Core i5-2500K (overclocked to 4GHz)	www.intel.com	$225
RAM	8GB Patriot DDR3/1600	www.patriotmemory.com	$42
Motherboard	Gigabyte GA-Z68XP-UD3	www.gigabyte.com	$155
GPU	XFX Radeon HD R7870	www.xfxforce.com	$359
Cooler	Cooler Master Hyper 212 EVO	www.coolermaster.com	$35
SSD	120GB OCZ Agility 3	www.ocz.com	$136
USB Expansion	NZXT IU01 Internal USB Expansion	www.nzxt.com	$18
OS	64-bit Windows 7 Home Premium	www.microsoft.com	$99
Total			$1,069

OLD LYNNFIELD GETS NEW LIFE

The LGA1156 socket is a dead end, but it's still plenty fast

At two years old, this CyberPower Gamer Xtreme 3200 can get a boost from the replacement of a few key components.

ORIGINAL BUILD

CPU	2.66GHz Core i5-750 running at 3.2GHz
RAM	4GB Kingston DDR3/1600
Motherboard	Gigabyte GA-P55-UD5
GPU	GeForce GTX 295
Cooler	Cooler Master V8
HDD	1.5TB 7,200rpm Seagate Barracuda 7200.11
ODD	22x Samsung DVD+R
OS	64-bit Windows Vista Home Premium
PSU	Cooler Master Scout / Corsair 750 TX

THE MACHINE

CyberPower PC's Gamer Xtreme 3200 is only 14 months newer than the Dell XPS 630i, but what a difference that time makes. The Xtreme 3200 packs the dual-GPU-based GeForce GTX 295 (two GeForce GTX 285 chips), a 2.66GHz Core i5-750, 4GB of DDR3/1600 RAM, and a 1.5TB Seagate Barracuda hard drive. When new, this machine sold for $1,600. In 2009 dollars, that's a pretty good deal for this much hardware, especially when you consider that it packs a dual-GPU graphics card. Much of the credit goes to the Core i5-750 chip, which made Intel's new Nehalem architecture affordable for the masses.

THE MISSION

This machine is just over two years old, and as such, it still has plenty of spark left. Still, two of its parts are now several generations behind. The first is the "Lynnfield" Core i5-750 chip on the long-obsolete LGA1156 socket (thanks, Intel!). LGA1156 puts a crimp on any serious CPU upgrades. The fastest LGA1156 chip available is the Core i7-880 or the more popular Core i7-870. Both are very decent chips, with the main difference between them and the Core i5 chip in the CyberPower being Hyper-Threading. You might wonder if HT is worth the hassle—it can be if you use multithreaded apps. However, we don't think it's worth the cost involved to get it on this board. A new Core i7-870 costs more than an Ivy Bridge or Sandy Bridge chip; even used it's fetching north of $220. The Core i7-880 is, umm, $800. We could almost buy our own ship for that!

We then considered junking the internals for something more modern,

BENCHMARKS

	PRE-UPGRADE	
Vegas Pro (sec)	4,501	3,064
Lightroom 2.6 (sec)	616	345
ProShow 4 (sec)	1,216	1,137
MainConcept 1.6 (sec)	2,618	2,377
STALKER: CoP (fps)	WNR	60.9 (N/A)
Far Cry 2 (fps)	77.2	143.6

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A modern GPU and SSD and a bit more RAM do wonders for performance.

but that felt wasteful. Yes, we'd pick up new technologies such as SATA 6Gb/s and the like, but the Core i5-750 is still very serviceable and really only two years old. With that decided, our mission was to boost the PC's performance capability and make it DirectX 11-ready with a few key upgrades.

THE UPGRADES

We picked two main upgrades: the first was to dump the GeForce GTX 295 for a GeForce GTX 680 card. The original GeForce GTX 295 sold for $500, so swapping it out for the $500 EVGA GeForce GTX 680 card seems apt. This gives us modern API support, higher frame rates, and—over time—a savings in power, too, as dual-GPU cards don't exactly sip power.

The second big upgrade was a 120GB Corsair Force GT SSD. Using the second-gen SandForce controller, the NANDs in this SSD are a bit faster than those in the OCZ SSD we used in the Dell, so we decided to splurge a bit. A third, less significant upgrade was adding 8GB of DDR3/1600. Yeah, 4GB is fine for most chores, but, what the hey, memory is still cheap. That brings the machine up to a total of 12GB of DDR3/1600. We also decided that since the machine is a bit older now, we'd push the overclock a bit harder. The Lynnfield CPU is overclocked by increasing the base clock (remember that?), so we increased it from 160MHz to 175MHz. That takes us to 3.5GHz, and with Turbo Boost on, we saw the clocks hitting the 3.8GHz range. The last upgrade was moving from Windows Vista to Windows 7. We long ago made peace with Vista after Microsoft released SP1 and SP2, but we've become so accustomed to Windows 7 that we think it's worth the $100.

UPGRADES

	PART	URL	PRICE
RAM	8GB Corsair Vengeance DDR3/1600	www.corsair.com	**$54**
GPU	EVGA GeForce GTX 680	www.evga.com	**$499**
SSD	120GB Corsair GT	www.corsair.com	**$169**
OS	64-bit Windows 7 Home Premium	www.microsoft.com	**$99**
Total			**$821**

THE RESULT

We didn't expect the same stellar performance difference with the CyberPower PC as we got with the Dell rig. After all, that machine received completely new innards. But despite being the most modest upgrade here, the CyberPower surprised us with its improved performance.

The combination of the increased RAM footprint, slightly higher clocks speeds, SSD, new GPU, and clean OS install gave us more than we expected in a few benchmarks. Sony Vegas Pro 9, surprisingly, saw a 47 percent performance bump. Adobe Lightroom also achieved a very healthy increase of 79 percent. In gaming, we saw an 86 percent jump in Far Cry 2, and our DirectX 11 test, STALKER: CoP, actually ran. In some tests, the results were more as expected, though. Main Concept Reference and ProShow Producer 4, for example, gave us about a 10 percent improvement, which matched our 10 percent overclock.

Overall, we think our upgrades make sense and extend the machine's service life. We might consider this stage one of our upgrade. Perhaps next year it'll be time to dump the Core i5-750 for Intel's next-generation mainstream socket, the LGA1150 and Haswell CPU.

REBUILDING THE DREAM

Part two of an ambitious upgrade to a 3-year-old 'Budget Surplus' machine

ORIGINAL BUILD

CPU	2.8GHz Core i7-920 Running at 3.5GHz
RAM	16GB Corsair Vengeance DDR3/1600
MOTHERBOARD	Gigabyte GA-EX58-UD3R
GPU	Sapphire Radeon HD 7950
Cooler	Thermalright TRUE-120 1366
HDD	1TB WD Caviar Black
ODD	LG Blu-ray player
OS	64-bit Windows 7 Professional
PSU	Thermaltake Element S / Corsair 850 TX

Here's our aging warrior after the first round of upgrades in May—still X58, but with a modern GPU and more RAM.

THE MACHINE

In our May 2012 issue's Build It section, we took a $1,400 gaming PC from our September 2009 issue and gave it a modest upgrade. The original rig was the midrange box in a trio of lean-year Dream Machines and was built around an Intel Core i7-920 and an ATI Radeon HD 4870 X2. It had three 2GB DDR3/1333 DIMMs, a 1TB hard drive, an LG Blu-ray drive, and an 850W Corsair power supply. The case was a Thermaltake Element S mid-tower.

In the course of our May upgrade, we took that aging PC and boosted it from 6GB of DDR3 RAM to 12GB (by buying a 16GB kit and using only three DIMMs). We also swapped the ancient, power-hungry dual-GPU card for a sleek Radeon HD 7950, but otherwise left the rig unchanged. The goal was to offer an immediate performance boost while paving the way for a second, more comprehensive round of upgrades down the line. That time is now.

THE MISSION

The Core i7-920 was an enthusiast CPU back in the day, and this Hyper-Threading-enabled quad-core is still no slouch. In fact, we could take the upgrades we've already made, add an SSD, and call it a day—and we wouldn't blame anyone who stops there. We'd still be stuck with a dead-end socket that has no feasible upgrade path, so we're biting the bullet and going for the major upgrade.

Since X58 was Intel's enthusiast platform at the time, we want to stay in the enthusiast realm while offering a generous upgrade path, so we'll need a CPU with plenty of juice now and a motherboard with room to grow. We hate to run a fancy rig without an SSD to improve load times and all-around system responsiveness, so we won't.

THE UPGRADE

We'll keep the RAM and GPU from May's upgrade, as well as the case, power supply, Blu-ray drive, and hard drive from the original build. Everything else gets an overhaul. In place of the Core i7-920, we'll use Intel's Core i7-3820. We briefly considered keeping the X58 platform and upgrading the CPU to a hexa-core Core i7-970, but they're $650 new and around $525 used. The Core i7-970 would add performance for multithreaded apps, but paying so much for a CPU on a dead-end socket didn't sit well with us. The Core i7-3820 is a quad-core Sandy Bridge-E part with

BENCHMARKS

	PRE-UPGRADE	
Vegas Pro (sec)	3,234	2,322
Lightroom 2.6 (sec)	394	256
ProShow 4 (sec)	1,184	857
MainConcept 1.6 (sec)	2,268	1,711
STALKER: CoP (fps)	60.3	61.2
Far Cry 2 (fps)	118.5	121.8

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And here's what it looks like now, complete with quad-channel RAM, a hefty Turbo overclock, speedy SSD, and front-panel USB 3.0.

Hyper-Threading that overclocks well despite not being an unlocked part. And our internal benchmarks indicate that its performance is competitive with older Westmere hexa-core chips anyway, so there's no point in buying the i7-970 when we can get the i7-3820 and a new X79 motherboard for the same price

Intel's DX79SI is short on frills but long on value. It's one of the less expensive X79 boards on the market, but it has eight RAM slots for up to 64GB of RAM and will support the upcoming Ivy Bridge-E CPUs—so if you want to upgrade to a hexa-core down the line, you can. Early boards required a BIOS update to play nicely with the i7-3820, but new ones should be fine. The DX79SI provides decent and intuitive overclocking support, even for locked processors like the Core i7-3820—we easily got our Turbo Boost to 4.4GHz.

We'll recycle the three 4GB DIMMs from the first part of our upgrade, and add the fourth. This is why we bought a 16GB kit instead of a 12GB kit in May—so we'd have the extra DIMM ready when it was time to go quad-channel.

Because of LGA2011's integrated universal backplate, we'll need a new cooler—Thermaltake doesn't sell an LGA2011 mounting kit for the Ultra Extreme 120. We like Xigmatek's Aegir due to its direct-contact heat pipes and powerful cooling performance.

Last we'll add an SSD. Solid-state drives dramatically reduce load times and come with blazing-fast read and write speeds. SanDisk's 240GB ExtremeSSD is a speedy SandForce-based 6Gb/s SATA SSD and is price-competitive with others in its class. 240GB is generous enough that we won't need to micro-manage programs, though we'll still want to make sure media and documents are kept on the 1TB drive.

Because the Element S is an older chassis, it has a few problems of its own. It doesn't have front-panel USB 3.0 ports, and though it shipped with 2.5-inch drive-bay adapters, they've long since vanished into the depths of the Lab. The front-panel connectors are just a few inches too short to reach the pins on the motherboard, though we split the blame for that between Intel and Thermaltake. Fortunately, all of those problems are easily solvable. Biostar makes an inexpensive 3.5-inch bay device with two USB 3.0 ports on an internal header, and Silverstone makes a 5.25-inch bay adapter that accommodates a 3.5-inch device and two 2.5-inch SSDs. A few NZXT front-panel connector extenders, and our case is ready for 2012.

UPGRADES

	PART	URL	PRICE
CPU	Intel Core i7-3820	www.intel.com	**$300**
Motherboard	Intel DX79SI	www.intel.com	**$270**
Cooler	Xigmatek Aegir	www.xigmatek.com	**$68**
SSD	240GB SanDisk ExtremeSSD	www.sandisk.com	**$290**
Front-panel USB 3.0	Biostar USB 3.0 Adapter	www.biostar-usa.com	**$14**
5.25-to-3.5-inch Drive Bay Adapter	Silverstone FP55	www.silverstonetek.com	**$16**
Front Panel Extensions	NZXT Front Panel Connector Extension	www.nzxt.com	**$8**
Total			**$966**

THE RESULTS

Color us unsurprised: A modern Sandy Bridge-E quad-core at 4.4GHz trounces a 2008-era Bloomfield quad at 3.5GHz. Thanks to the overclocked i7-3820 and the SandForce SSD, we saw huge gains in CPU- and drive-limited benchmarks. Our MainConcept Reference score was 33 percent faster than the pre-upgrade rig, ProShow Producer showed 38 percent improvements, our Vegas Pro 9 score went up 39 percent, and our Lightroom test was as whopping 54 percent speedier.

With the GPU and RAM upgrades we made a few months ago, we've gone from an aging X58 gaming PC with a hot, slow GPU and a dead-end motherboard to a fresh, speedy gaming PC on Intel's latest enthusiast socket—one that doesn't lack for modern amenities like front-panel USB 3.0, a capacious boot SSD, or modern graphics.

Granted, the only parts this machine has in common with the one we built in September 2009 are the case, power supply, optical drive, and hard drive, but it's still the same rig, right? Or maybe it isn't. What's important is that it's blazing fast, actually draws less power than the original, and is ready for the future.

UPGRADING DOs AND DON'Ts

Adherence to a few simple guidelines can make your upgrade go much more smoothly

DON'T REUSE YOUR THERMAL PASTE

If you upgrade your CPU or heatsink, you may be tempted to just plop the old heatsink back in place, but it's generally recommended that you clean off the old thermal paste and re-apply fresh paste to the new CPU or heatsink. If the old thermal paste is gunked on like concrete, it may take more than elbow grease to clean it off. We use Arctic Silver's ArctiClean, but a bit of 99 percent isopropyl alcohol also works in a pinch.

DON'T UNDERESTIMATE YOUR POWER NEEDS

Just upgraded from a single card to a dual-GPU card? Sure, the plugs may fit, but if your PSU is sagging under the load on a cool day, it'll get even worse when temperatures rise. It can be tough to gauge the power requirements, so check with the GPU vendor for what your new card requires.

DON'T UNDERESTIMATE YOUR COOLING NEEDS

If you just swapped a G-series Pentium for a Core i7-2700K you should probably upgrade your heatsink fan, too, as a faster CPU usually means more heat. If you're using the stock Intel cooler, keep in mind that the budget chip's cooler might look the same, but it's actually different from the higher-performing heatsinks.

DON'T THROW AWAY THOSE OLD PARTS

So you just added a second optical drive and upgraded the GPU. Just throw away that old bezel and expansion card slot cover, right? Not so fast, buddy. We recommend that you save those parts for the future when you decide to give away the case. That's usually when you start looking for that old bezel or other parts that you thought you didn't need anymore.

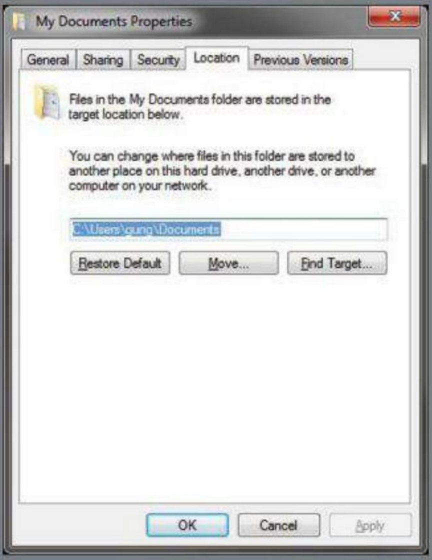
DON'T REUSE YOUR OLD WINDOWS INSTALL

We know, we know, one of the pains of doing a major upgrade is dealing with an OS reinstall. However, when your upgrade involves swapping the motherboard and chipset, it's recommended that you do a clean install. You can get away with just letting Windows redetect the new hardware, but a clean install will protect you against any potential problems.

DO PERFORM A BACKUP

Before you do your upgrade, we recommend that you take the time to perform a full backup of your files. Why? Because this is the time when something breaks and the last person who touched it gets blamed for the breaking, even if you had nothing to do with it. So consider this your public service announcement.

DO MOVE YOUR DEFAULT LIBRARIES



If you just upgraded to an SSD, don't forget to move your default library location from that limited-space SSD to your HDD. Do this by clicking the Start button on Windows 7 and selecting Documents. In the left-hand pane, expand the Documents entry by clicking it and then right-click My Documents. Select the Location tab and click Move to move it to your HDD.

DO TIDY UP THE INTERIOR

If you have four years' worth of cat hair circulating in your PC, it's time to clean it. We use a vacuum cleaner to carefully suck up the dust bunnies. Take care not to get the vacuum so close as to remove components from your motherboard and GPU. Also clean the case's filters and vents of dust. If your wiring is a mess, now is also a perfect time to make it ship-shape.

DO MAKE THE JUMP TO AHCI

If your machine is old enough, you likely did not have AHCI, or Adaptive Host Control Interface, enabled, as many motherboards left it off by default. AHCI lets you take advantage of advanced capabilities such as support for booting to devices larger than 2.2TB, native command queuing, and hot swapping. You should only enable AHCI if you're doing a clean install of the OS, which would be the case if you're installing a hard drive or SSD. If you enable AHCI without doing a clean install, Windows 7 will fail to boot until you turn it off.

DO CHECK YOUR AIRFLOW

Since you're in your box tinkering around, we recommend that you take a look at the case's airflow. Generally, you want air flowing from the front of the case to the rear of the case where it's exhausted. You can reposition fans and adjust fan speeds to help with this. We generally recommend running more intake fans than exhaust fans in dustier environments. This should aid positive air pressure in the case and help reduce dust issues.

"★★★★★"
Amazing app, and it's FREE!
by Vitsnuklz
"THE BEST GUIDES on the internet... ALL IN ONE PLACE"
by Samael76
"Thank you GamesRadar for FEEDING MY ADDICTION"
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WorldMags

BY NATHAN EDWARDS

DUAL OF THE FATES

IS NVIDIA'S GTX 690 A DUAL-GPU CARD WORTH BUYING?

IT'S BIG. It's beautiful. It costs one thousand dollars. Nvidia took two of its fastest Kepler GPUs and put them on the same dual-slot videocard. The resulting behemoth, dubbed the GTX 690, begs for attention. But the last generation of AMD and Nvidia dual-GPU cards was hot, loud, and disappointing. Does the GTX 690 carry on that ignoble tradition, or is it as good as it looks?

Magnesium alloy. Chromium-plated aluminum. Polycarbonate windows. This ain't your typical reference card.

WorldMags

> IT'S CLEAR THAT NVIDIA SPENT SERIOUS TIME WORKING ON THE REFERENCE SHROUD

Getting the Outside Right

The graphics card goes inside your computer and makes the stuff that comes out of your computer look good. It doesn't matter what the graphics card looks like on the outside (so long as it has, say, heatsinks and a fan shroud), just how powerful it is on the inside, and Nvidia and AMD's reference cards are usually reflections of this boring truism. In the battle for differentiation, though, third-party card vendors go to town, with custom fan shrouds and cooling systems that alternate between garish and gorgeous.

It'd be hard for any after-market vendor to improve on Nvidia's GTX 690 reference design, however. It's not just the prettiest reference card we've ever seen; it may be the most beautiful videocard we've seen, period.

The GTX 690 is a dual-GPU graphics card that's 11 inches long—big for an Nvidia card, but far smaller than the 12.2-inch

SPECIFICATIONS

	GeForce GTX 690	GeForce GTX 680	Radeon HD 7970	GeForce GTX 590
Number of Cores	3,072*	1,536*	2,048*	1,024*
Texture Units	256	128	128	128
ROPs	64	32	32	96
Base Clock Frequency	915MHz	1,006MHz	1,000MHz	607MHz
Boost Clock Frequency	1,019MHz	1,058MHz	N/A	N/A
Memory Clock Frequency	1,502MHz actual	1,502MHz actual	1,375MHz	854MHz
L2 Cache Size	1,024KB (512KB per GPU)	512KB	768KB	1,536KB (768KB per GPU)
Frame Buffer Size	4,096MB (2,048MB per GPU)	2,048MB	3,072MB	3,072MB (1,536MB per GPU)
Memory Interface	2x 256-bit	256-bit	384-bit	2x 384-bit
Memory Data Rate	6Gb/s	6Gb/s	5.5Gb/s	3.4Gb/s
Manufacturing Process	28nm	28nm	28nm	40nm
Transistor Count	7.08 billion	3.5 billion	4.3 billion	3 billion
Connectors	3x dual-link DVI, 1x Mini DisplayPort 1.2	2x dual-link DVI, 2x HDMI 1.4a (Fast), 2x DisplayPort 1.2	2x Mini DisplayPort, 1x dual-link DVI, 1x HDMI 1.4a (Fast)	3x dual-link DVI, 1x Mini DisplayPort 1.1a
Power Connectors	2x 8-pin	2x 6-pin	1x 6-pin, 1x 8-pin	2x 8-pin
Thermal Design Power (TDP)	300W	195W	250W	365W

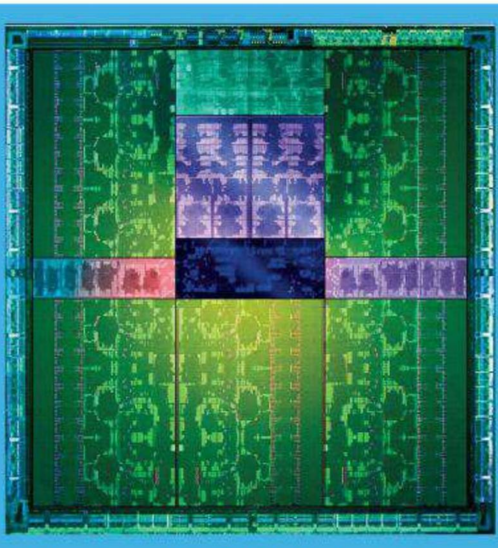
* Note: Nvida and AMD graphics compute cores are not directly comparable.

WHITHER BIG KEPLER?

The GPU in the GTX 680 and 690 is designated GK104, and the "104"-designated GPUs aren't usually the biggest, most powerful of their generation. The Fermi GF104, for example, powered the GeForce GTX 460, a midrange card, while the later GF110 (a smaller, more power-efficient version of the GF100) is the GPU in the GTX 580. So where's the GK110, and what sort of videocards will it power?

Nvidia dropped some info on the GK110 at this year's GPU Technology Conference. What do we know? Well, it's not for us. Yet.

The GK110 will first appear in the Tesla K20, an enterprise-level card focused on GPU computing, not graphics. It contains a whopping 7.1 billion transistors—double that of the GK104—and will have up to 2,880 CUDA cores. The GK104 has 1,536. The GK110 will also support Dynamic Parallelism and Hyper-Q, two technologies that make it very attractive for GPU computing but won't be relevant to gamers. The Tesla K20 is coming in Q4 2012, so we'd expect a consumer videocard based on the GK110 sometime after that, if at all. Don't hold your breath.



Nvidia released this GK110 die shot in May.

high water mark established by the AMD Radeon HD 5970 a few generations ago. It takes up the usual two PCI expansion slots. It requires one x16 PCIe slot, two 8-pin power connectors, and is fully PCIe 3.0 compliant. The rear of the card contains three dual-link DVI ports and a DisplayPort 1.2 port, and the GTX 690 can actually drive four monitors at once.

Rather than the usual black plastic, Nvidia has wrapped the GTX 690 in chromium-plated cast aluminum, with an injection-molded magnesium-alloy fan housing. Polycarbonate windows cover the vapor chambers over each GPU while keeping the cooling channels visible. The "GeForce GTX" logo on the side even lights up. Our one complaint about the GTX 690's externals is the same one we had about the GTX 590: The center-mounted fan blows hot air toward both the front and the back of the videocard, working against the normal front-to-back airflow of a typical cooling setup.

It's clear that Nvidia spent serious time working on this reference shroud, and it looks amazing. But looks aren't the reason to buy a graphics card: Nvidia says the precision-machined aluminum and metal cut down on vibration and fan noise. All that's very cool, of course, but you can't judge a videocard by its cover—or by the nice things its manufacturer says about it.

The Inside Scoop

The GTX 690 contains two of Nvidia's premiere Kepler GK104 GPUs—the same GPU as in the top-tier GTX 680 single-GPU card. We've discussed the Kepler architecture at length, most prominently in our June 2012 feature article ("Nvidia's Kepler: Overcoming the Sins of Fermi"), so we'll refrain from discussing the basic architecture, but it's Nvidia's fastest, coolest, most power-efficient top-end GPU to date.

The GTX 690's two GK104 GPUs sit on each side of the center-mounted fan and are connected to each other and to the motherboard via a 48-lane PLX bridge chip. Each chip is a full GK104: 1,536 CUDA cores, 128 texture units, 64 ROPs, and 2GB of 256-bit GDDR5, for a total of 3,072 CUDA cores, 256 texture units, 128 ROPs, and 4GB 6,008MHz GDDR5 across the card. The whole package has a TDP of 300W, compared to 195W for a single GTX 680.

Where previous dual-GPU cards, like the GTX 295 and 590, had substantially underclocked GPUs to meet the board's thermal and power limitations, the GPUs on the GTX 690 are only slightly underclocked: 915MHz with a 985MHz GPU boost clock, compared to the 1,006MHz base and 1,058MHz boost clock of a reference GTX 680. Nvidia has

BENCHMARK

	Nvidia GTX 690	Nvidia GTX 680 SLI	AMD Radeon HD 7970 CrossFireX	Asus GTX 590
Price	$1000	$1,000	$960	N/A
3DMark 11 Performance	P15104	**P15804**	P13817	P9843
3DMark 11 Extreme	X5800	**X6072**	X5352	X3300
3DMark Vantage Performance	P44501	**P45205**	P44180	P36250
Unigine Heaven 2.5 (fps)	59.8	**60.8**	57.6	35.9
Shogun 2 (fps)	37.9	38	**75**	31.6
Far Cry 2 / Long (fps)	184.7	**187.9**	186.3	129.3
Dirt 3 (fps)	122.9	**124.5**	114.5	73
HAWX 2 (fps)	224	225	**229**	178
Metro 2033 (fps)	**29.6**	29.5	29	24
STALKER: CoP DX11(fps)	64.6	66.1	**76.7**	42.3
Just Cause 2 (fps)	79.31	81.03	**91.85**	54.91
Batman: Arkham City (fps)	102	**104**	86	68
Base Clock (Actual)	915MHz	1,006MHz	1,000MHz	608MHz
Boost Clock	985MHz	1,056MHz	N/A	N/A
Memory Clock	1,502MHz	1,502MHz	1,425MHz	854MHz
System Power @ idle (W)	**101**	110	102	105
Max System Power @ full throttle (W)	**567**	813	815	613

Best scores bolded. Our GPU test bed consists of a stock-clocked Intel Core i7-3960X on an Asus P9X79 Deluxe board with 16GB DDR3/1600, a 256GB Samsung 830 Series boot SSD, and a 1050W Thermaltake Toughpower Grand PSU, in a Cosmos II chassis. All tests performed at 2560x1600 with all settings maxed and 4x MSAA except where noted. Power use measured with a Watts Up Pro.

WorldMags

built in substantial room for overclocking, too, and proclaims 1,100MHz-plus boost clocks from the stock configuration. Regardless, Nvidia says a stock-clocked GTX 690 will perform to within a few percentage points of SLI'd GTX 680s.

Performance Double

We tested the reference GTX 690 against two-card setups of the fastest single-GPU reference cards on the market: two GTX 680s in SLI, and two Radeon HD 7970s in CrossFireX. To see how far we've come, we also tested an Asus GTX 590—Nvidia's last-generation dual-Fermi card. We tested each configuration on the same test bed: a stock-clocked Intel Core i7-3960X on an Asus P9X79 Deluxe board with 16GB DDR3/1600, a 256GB Samsung 830 Series boot SSD, and a 1050W Thermaltake Toughpower Grand PSU, in a Cosmos II chassis. We ran every test on 64-bit Windows 7 Professional SP1 using the latest drivers available for each card at the time of testing. We ran all the gaming benchmarks at 2560x1600 resolution with all settings maxed and antialiasing set to 4x MSAA where available. PhysX was turned off in games that used it.

If the GTX 690 is one thing, it's fast. If it's two things, it's fast and consistent. In every benchmark, the GTX 690 is just slightly slower than two stock-clocked GTX 680s in SLI—on the order of one or two frames per second at 2560x1600. The Kepler setups perform better, by a little, than the CrossFireX'd Radeon HD 7970 reference cards in Unigine Heaven 2.5, Far Cry 2, and Metro 2033, and by a wider margin in Dirt 3 and Batman: Arkham Asylum. The Radeons push out decent wins in Just Cause 2 and Stalker, with a large advantage in Total War: Shogun 2.

The GTX 690, SLI'd GTX 680s, and CrossFireX'd Radeon HD 7970s all kick the snot out of the dual-Fermi GTX 590 (originally reviewed June 2011). In boring lockstep with Nvidia's promotional materials, the GTX 690 is between 20 percent (in Shogun 2) and 66 percent (in Unigine Heaven) faster than the GTX 590. It also draws less power—we saw a peak total system power of 567W for the GTX 690, compared to 613W for the GTX 590 and over 810W for each of the two-card setups. All four setups idled between 101W and 110W, though the AMD has ZeroCore technology, which drops card power consumption to just 3W when the attached monitor is off. Nvidia's cards lack this feature.

The GTX 690 isn't necessarily quiet, but it's not loud. We'd be happier if the airflow didn't wreak havoc on conventional cooling systems, but the central fan keeps both GPUs cool, so we can't complain too much.

Overkill, Or the Right Amount of Kill?

The Nvidia GTX 690 is the fastest consumer graphics card you can buy. It's roughly as fast as two GTX 680s and beats dual Radeon 7970s in most benchmarks. That is to say it's roughly twice as fast as the fastest single-GPU cards on the market. That's a big deal. Expect third-party vendors to ship factory-overclocked versions that'll be even faster.

It's also $1,000 dollars, and it's complete overkill for most gamers. Most people don't even need one GTX 680, much less two, unless you're gaming on multiple high-res panels. In 3D. On the other hand, GPU compute users, visual artists, and other people who need massive rendering power immediately but aren't in Tesla or Quadro territory might find the GTX 690 a budget option.

If you really do need multiple top-end GPUs, the GTX 690 takes up less room and draws less power than two 680s, but costs the same amount and makes less noise. It's the obvious choice for an SLI setup. And if you're an AMD fan? The Radeon HD 7970s still outperform a dual-Kepler setup in a few benchmarks, but AMD hasn't revealed its dual-GPU Southern Islands card yet. The rumored 7990 is just that: rumored. Given the performance of the GTX 690, though, we hope AMD has something special up its sleeve.

RADEON HD 7990: COMING SOON?

The Radeon HD 7990 is currently slated for a July 2012 launch, according to a source familiar with the project. Why not earlier?

First, our source claims that AMD's Radeon HD 7970 is handily outselling Nvidia's GTX 680, at least in part because of Nvidia's scarce supply of GK104 parts (though Nvidia denies any yield issues), so AMD's in no hurry to release a dual-GPU card. Second, most of AMD's driver engineers have been working on the Trinity APU. With Trinity's launch, those engineers are free to work on Radeon drivers. This leads us to the third thing our source said: AMD won't release the Radeon HD 7990 until it can beat the GTX 690, which the company thinks it can do in time for a July launch. Nvidia, by the way, says it doesn't anticipate a serious GTX 690 competitor for the next six to nine months. Fightin' words!

We hope the 7990 doesn't look as plain-Jane as AMD's last dual-GPU card, shown here.

BUILD IT

NATHAN EDWARDS **SENIOR EDITOR**

Make Way for the Midsize Menace

Pound for pound, you know the sound: Here's a Kepler-powered microATX gaming rig that won't break the bank—or your back

LENGTH OF TIME: **2 HOURS** LEVEL OF DIFFICULTY: **INTERMEDIATE**

THE MISSION Oh, microATX. You're the awkward middle child of motherboard form factors: neither as fully powered as a regular ATX board nor as compact as Mini-ITX. On the other hand, it's possible to build a hell of a rig with microATX in a relatively small footprint without compromising power, and I've been intending to do so for a while. I took a shine to the X79-powered microATX mobo Gordon Mah Ung reviewed in the April 2012 issue, and when the sky angels slipped a Kepler GPU into my rucksack, I knew what I had to do.

It's not going to be easy fitting all these high-powered parts into a minuscule chassis, but if you want easy, build a full-size machine. When I'm done, I'll have a box just 14.5 inches tall, 15.2 inches deep, and 8.25 inches wide—one that kicks a disproportionate amount of ass, no matter how tricky we have to get with the zip ties.

CHOOSING THE HARDWARE

I'VE HAD MY eye on Silverstone's TJ08-E microATX case since we reviewed it in March 2012. It's a bit cramped, but it has good airflow and a sleek aesthetic—as well as an unusual motherboard orientation—and it has plenty of room for long videocards and a few drives.

Now, most microATX motherboards suffer from budget-itis: They're cheap and underpowered compared to full ATX boards. The Asus Rampage IV Gene? Not so much. It has LGA2011 support, quad-channel memory (though only four DIMM slots), 6Gb/s SATA ports, three 16x PCIe slots, great onboard audio, and ground-effect LEDs. Just for fun.

Intel's Core i7-3820 is a great processor, and an obvious choice for an LGA2011 CPU under $300. It's a quad-core part at 3.6GHz stock and includes HyperThreading. Plus, if you want to upgrade to a six-core CPU later, LGA2011 is the only way to fly.

The Rampage IV's RAM slots are close to the CPU socket, so I can't use an enormous CPU cooler. NZXT's Havik 120 features dual fans and excellent performance, but I'm still using RAM with low-profile heat spreaders to avoid bumping up against the fans.

For storage, I'm sticking with my personal price/performance sweet spot: a 120GB 6Gb/s SATA SSD and a 3TB storage drive.

There's not much room in the TJ08-E for excess cabling or lengthy PSUs, so I'm using the Silverstone Strider Plus 750W, which is fully modular and only 6.3 inches deep. This should help me keep my wiring tidy.

Oh, and I'll be using Nvidia's brand-new GeForce GTX 680, which is faster than the GeForce GTX 580 and competitive with the Radeon HD 7970 but uses just two 6-pin power cables (see Loyd Case's detailed Kepler breakdown on page 42). At $500, this card is a hell of a deal, sips power (for a high-end GPU), and fires a pretty big shot directly across AMD's bow.

INGREDIENTS

	PART	URL	PRICE
Case	Silverstone TJ08-E	www.silverstonetek.com	$95
PSU	Silverstone Strider Plus 750	www.silverstonetek.com	$140
Mobo	Asus ROG Rampage IV Gene	www.asus.com	$290
CPU	Intel Core i7-3820	www.intel.com	$285
Cooler	NZXT Havik 120	www.nzxt.com	$55
GPU	Nvidia GeForce GTX 680	www.nvidia.com	$500
RAM	16GB Corsair Vengeance LP	www.corsair.com	$130
Optical Drive	Plextor CD/DVD burner	www.plextor.com	$20
Hard Drive	3TB Seagate Barracuda	www.seagate.com	$190
SSD	Corsair Force GT 120	www.corsair.com	$170
OS	Windows 7 Professional 64-bit (OEM)	www.microsoft.com	$139
Total			$2,014

UNDER THE MAGNIFYING GLASS

The TJ08-E's cramped quarters and unusual layout mean I can't follow a typical build order. Instead, the steps are optimized for cable management as well as, well, component management. Here are the highlights.

1 FIRST, ADD POWER

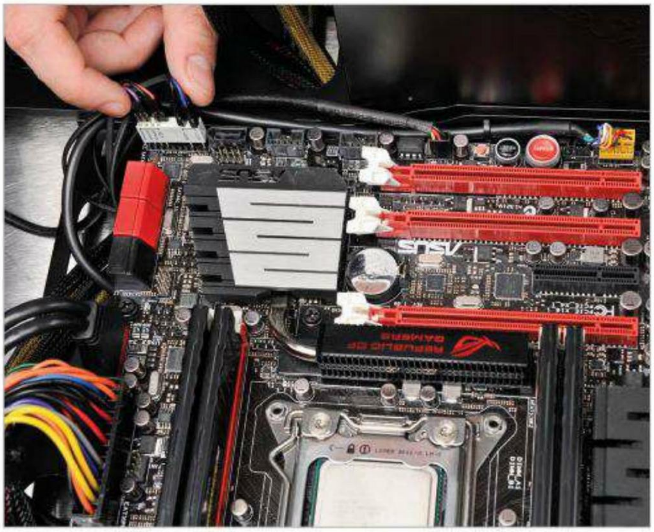
REMOVE THE TJ08-E's side panels, then remove the six screws securing the top panel and take that off, too. Make sure the following cables are attached to the PSU: 24-pin and 8-pin ATX, two 6-pin PCIe power, and two SATA power cable strands. Remove the rest of the modular cables and slide the PSU into the top of the case, fan side up. Secure it with four screws (I used the PSU's included thumbscrews) and pull the cables through the opening that leads behind the motherboard tray.

2 WHAT DRIVES YOU

NEXT, WE'LL INSTALL the drives. Lay the case on its side and remove the four screws securing the drive cages to the bottom of the case. Remove the trays and secure the SSD directly to the bottom of the case.

3 WORD TO YOUR MOTHERBOARD

MOUNT THE RAM and CPU into the motherboard, install the I/O shield into the case, then mount the motherboard into the chassis. Bring your 8- and 24-pin motherboard power connections behind the motherboard tray toward their respective connectors and plug them in. Now is also a good time to start connecting front-panel connectors, like USB 3.0, audio, power and reset switches, and LEDs.



4 DRIVES PART DEUX

WITH THE MOTHERBOARD in place, it's time to add the storage drive. Take the lower hard drive cage (the one-bay one) and mount the hard drive into it with four screws in the mounting holes marked HDD. Reattach the hard drive cage to the bottom of the case. You can either remove the empty top three-drive cage for a less cluttered case or leave it in, to channel air from the intake fan toward the CPU fans. It also includes a pad to support the GPU, if you're into that.

Run a three-port SATA power cable from the PSU to the drives. Plug the last power adapter on the string into the hard drive, then tuck the cable under the drive and plug the second plug into the SSD. Attach SATA data cables to both drives and plug them into the middle red ports on the motherboard. Those are the native Intel 6Gb/s SATA ports.

Install the optical drive in the top 5.25-inch bay and secure it with four screws, then connect SATA power and data.

5 COOL (AND THE GANG)

NOW THAT ALL the fiddly bits are ready, it's time to install the CPU cooler. Install the four double-sided mounting thumbscrews, add the mounting bars, secure them with nuts, and apply a small dot of thermal paste to the CPU. Mount the heatsink with the crossbar and tighten the screws evenly, alternating every few turns until the CPU is secure. Secure the fans onto the heatsink, making sure they are drawing air from the front of the chassis and exhausting it toward the rear. Plug both fans into the included Y-connector and attach them to the CPU_FAN header on your board.

6 GAME ON

LAST, YOU'LL install your GPU. Remove the metal cover that blocks access to the expansion slots, then remove the lower two expansion slot covers (what would be the top two, if the case's motherboard orientation weren't upside down.) Install the GPU into the PCIe slot closest to the CPU cooler. If you left the top drive cage in, the end of the GPU should rest atop the cage. Secure the card into the expansion slots and plug in the two 6-pin power cables. Double-check your power and data connections, replace the metal cover, and turn the case upright. Reattach the top and side panels, and power on!

1. The TJ08-E's front fan, an 18cm Air Penetrator, is powerful enough to cool everything in the rig, thanks to the case's simplified airflow.

2. I left the empty drive cage in place to help channel air to the CPU cooler, but you can remove it if you prefer a less cluttered interior.

3. The last-minute addition of an Nvidia GTX 680 gives my rig more oomph but ruins the nice black-and-red color scheme I was going for.

PUNCHING ABOVE ITS WEIGHT CLASS

THE MIDSIZE MENACE IS small, yet mighty. It's functionally equivalent to our Tax Refund PC from last month, but in a smaller package. It uses the same CPU and amount of RAM, as well as a similar GPU. The SSD in the Midsize Menace is a little faster, and the storage drive is larger and faster, but the Tax Refund PC has a Blu-ray drive and a higher-wattage PSU.

So how much smaller is the Midsize Menace than the Tax Refund PC, which we housed in an NZXT Phantom 410 midtower chassis? The Midsize Menace, in a Silverstone TJ08-E, is just under six inches shorter than the TRPC, five inches shallower, and about a quarter-inch narrower. That makes for a lot less bulk on your desk.

Using the Rampage IV's Gamer OC BIOS setting, it took about two seconds to get a stable 4.4GHz overclock on the 3820, and Gordon Mah Ung's experience last month shows that the 3820 can be easily overclocked to 4.7GHz on air. At 4.4GHz, though, it's within spitting distance of last month's Tax Refund machine, and the differences are attributable to the clock speed. More time with the Midsize Menace, and it'd be just as fast as last month's high-end box.

If you don't mind a cramped build process and the loss of some elbow room (as well as expandability down the line), you can get a machine that's just as fast as the Tax Refund PC but more compact, for the same amount of money—or even a little less.

BENCHMARKS

	ZERO POINT	
Vegas Pro (sec)	3,049	2,319
Lightroom 2.6 (sec)	356	270
ProShow 4 (sec)	1,112	915
MainConcept 1.6 (sec)	2,113	1,707
STALKER: CoP (fps)	42.0	62.3
Far Cry 2 (fps)	114.4	151.1

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a quad-core 2.66GHz Core i7-920 overclocked to 3.5GHz, 6GB of Corsair DDR3/1333 overclocked to 1,750MHz, on a Gigabyte X58 motherboard. We are running an ATI Radeon HD 5970 graphics card, a 160GB Intel X25-M SSD, and 64-bit Windows 7 Ultimate.

BUILD IT

NATHAN EDWARDS **SENIOR EDITOR**

Building (Ivy) Bridges in the Sky

Intel's new 22nm "tick" brings native USB 3.0, PCIe 3.0, and twice the integrated graphics performance (not that we'll need it) to Socket LGA1155

LENGTH OF TIME: **1.5 HOURS** LEVEL OF DIFFICULTY: **INTERMEDIATE**

THE MISSION Intel's Ivy Bridge CPUs (and the corresponding Z77 Panther Point chipset) finally dropped in late April, and Ivy Bridge brings more than just the expected thermal and power improvements over Sandy Bridge. You can read an in-depth report on Sandy Bridge in the June 2012 issue of *Maximum PC*, but for our purposes, it's enough to know that the Ivy Bridge Core i7-3770K is the successor to the Sandy Bridge Core i7-2600K. It has a slightly faster clock speed than the 2600K, but it requires less power and delivers more performance per clock than its predecessor.

It doesn't make sense to upgrade from a Sandy Bridge to an Ivy Bridge processor or motherboard, but if you're building a new PC, Ivy Bridge is the way to go.

This month's project, then, is simple: Build a new gaming PC with an Ivy Bridge motherboard and CPU. I'll also be using Nvidia's GTX 680 GPU and Western Digital's new 1TB VelociRaptor, just for kicks.

CHOOSING THE HARDWARE

THIS IS A MACHINE built from the CPU out. The CPU, of course, is Intel's new Core i7-3770K, the successor to the 2600K. The 3770K is a quad-core 3.5GHz CPU with Hyper-Threading and 8MB of L3 cache, not to mention Intel's new HD 4000 integrated graphics (which we won't be using). And with a TDP of just 77W, it's a power sipper.

The 3770K gets a brand-new motherboard to go with it. Asus's P8Z77-V Pro gives the perfect mix of price and performance—it supports up to 32GB of RAM and it has two x16 PCIe 3.0 slots, two native Intel USB 3.0 ports as well as some Asmedia ones, and both native Intel and Asmedia 6Gb/s SATA ports. It also includes a Wi-Fi/Bluetooth dongle, which is cute and potentially useful.

Because of the CPU's low TDP, Xigmatek's Gaia cooler will be sufficient even with a moderate overclock. It can cool an overclocked Core-i7 3960X; it can handle this.

The PSU is a bit overkill, but it gives me breathing room if I want to add a second GPU later.

Nvidia's GTX 680 is the new 900-pound gorilla; it's faster than AMD's Radeon HD 7970 in most benchmarks and it's just $500. It also consumes less power than the 7970 during use.

With RAM so cheap, it's tempting to get 16GB, but 8GB is plenty for a gaming machine, so I'll stick with that for now.

Western Digital's latest VelociRaptor is 1TB of 10,000rpm mechanical storage. It's not as speedy as an SSD, but it averages 160MB/s read and writes with random-access times that are twice as fast as a standard mechanical drive. I normally prefer an SSD/HDD combo, but this is my chance to get out of my comfort zone a little bit and see what the VelociRaptor can do.

I'm also stepping out of my comfort zone with the case. Enermax's Fulmo is a mid-tower with plenty of stock air cooling, striking blue LED fans, and a look that's reminiscent of Cooler Master's 690 II Advanced, but with a far more interesting interior.

INGREDIENTS

	PART	URL	PRICE
Case	Enermax Fulmo Advance	www.enermaxusa.com	$99
PSU	Thermaltake Toughpower Grand 850W	www.thermaltakeusa.com	$190
Mobo	Asus P8Z77-V Pro	www.asus.com	$225
CPU	Intel Core i7-3770K	www.intel.com	$315
Cooler	Xigmatek Gaia	www.xigmatek.com	$30
GPU	Nvidia GTX 680	www.nvidia.com	$500
RAM	8GB Corsair Vengeance	www.corsair.com	$50
Optical Drive	Samsung SH-222AB CD/DVD burner	www.samsung.com	$20
Hard Drive	1TB WD VelociRaptor	www.wdc.com	$320
OS	Windows 7 Professional 64-bit (OEM)	www.microsoft.com	$139
Total			$1,888

1 COOL IT, MAN

INSTALL the CPU, RAM, and cooler onto the motherboard before installing the mobo into the case, because the Xigmatek Gaia's rubber fan mounts are friggin' annoying. The i7-3770K is a standard LGA1155 CPU, so you'll just need to open the lift arm, align the CPU into the socket, place it down gently, and re-secure it by closing the socket gate and lift arm. The Gaia uses a backplate with four tall mounting posts that poke through the motherboard to surround the socket; secure it to the motherboard with the knurled nuts.

Apply a smallish dot of thermal paste to the center of the CPU heat spreader, then slide the Gaia heatsink down the posts to rest on the CPU and secure with the mounting nuts. Secure the fan to the RAM side of the heatsink using the rubber mounting posts **(image A)** and plug the fan into the CPU_FAN header. Install the RAM into the two blue RAM slots.

A

2 STAND BY, FAN CONTROL

THE FULMO includes front-panel fan speed and LED control, but in order for it to work the three controllable fans (two 12cm front panel fans and one 18cm side intake fan) have to be wired to specific controller boards inside the case, and I learned from experience that it's easier to do this before any of the parts are in the case.

There are two 2-pin leads from the top of the case: The shorter one goes to the first connector in the LED control panel at the center-right of the motherboard tray, and the other goes to the fan-speed control at the lower right of the mobo tray. Plug the 2-pin leads from the front fans into the LED control panel **(image B)** and the 3-pin leads to the lower two 3-pin connectors on the speed-control panel **(image C)**. Each panel will have an extra connector; those are for the 18cm fan on the side panel.

B

C

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3 THE MOTHER OF ALL BOARDS

NOW THAT THE FANS are configured and the CPU, RAM, and cooler are mounted to the motherboard, it's time to place the motherboard into the case. Make sure all nine ATX motherboard standoffs are installed, and then place the I/O shield into its opening. Mount the motherboard into the case, making sure all nine mounting holes are used. Connect the HD_Audio, USB 2.0, USB 3.0, and front-panel connectors to the motherboard.

4 GIMME POWER

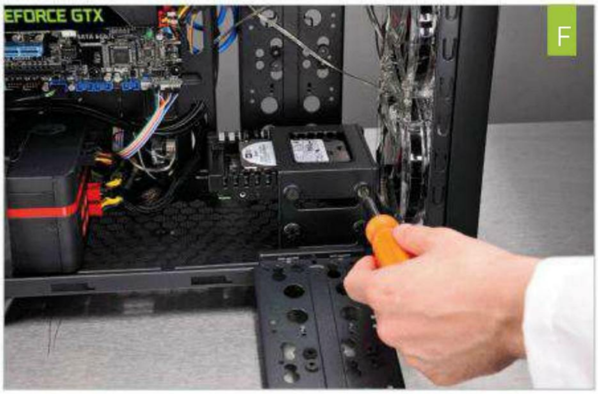
CABLE ROUTING IS my least favorite part of the Enermax Fulmo case, so it's best to be scientific about it. Install the PSU into the bottom of the case (with the fan pointing down), then connect only the cables you'll need: two 6-pin PCIe cables, one 4-pin Molex strand, and one strand of SATA power connectors. Route all but the 24-pin motherboard power cable through the grommeted hole right next to the PSU, and run the 24-pin through the non-grommeted hole on the far side of the fan controller **(image D)**. Bring the 8-pin ATX power cable through the hole at the top left of the mobo tray and connect it to the mobo; then bring the 24-pin cable through the mobo tray next to its connector and plug that in, too.

5 GETTING GRAPHIC

ANOTHER JOY of the Fulmo: It uses plastic PCIe slot retention brackets that are absolutely useless if you have a dual-slot card like the GTX 680—or indeed most modern videocards. Install the GPU into the top 16x PCIe slot and secure it using two screws **(image E)**, then shake your fists at the gods of plastic PCIe retention clips. Bring the two 6-pin PCIe power cables through a hole in the mobo tray and connect them to the GPU.

6 DRIVE-IN

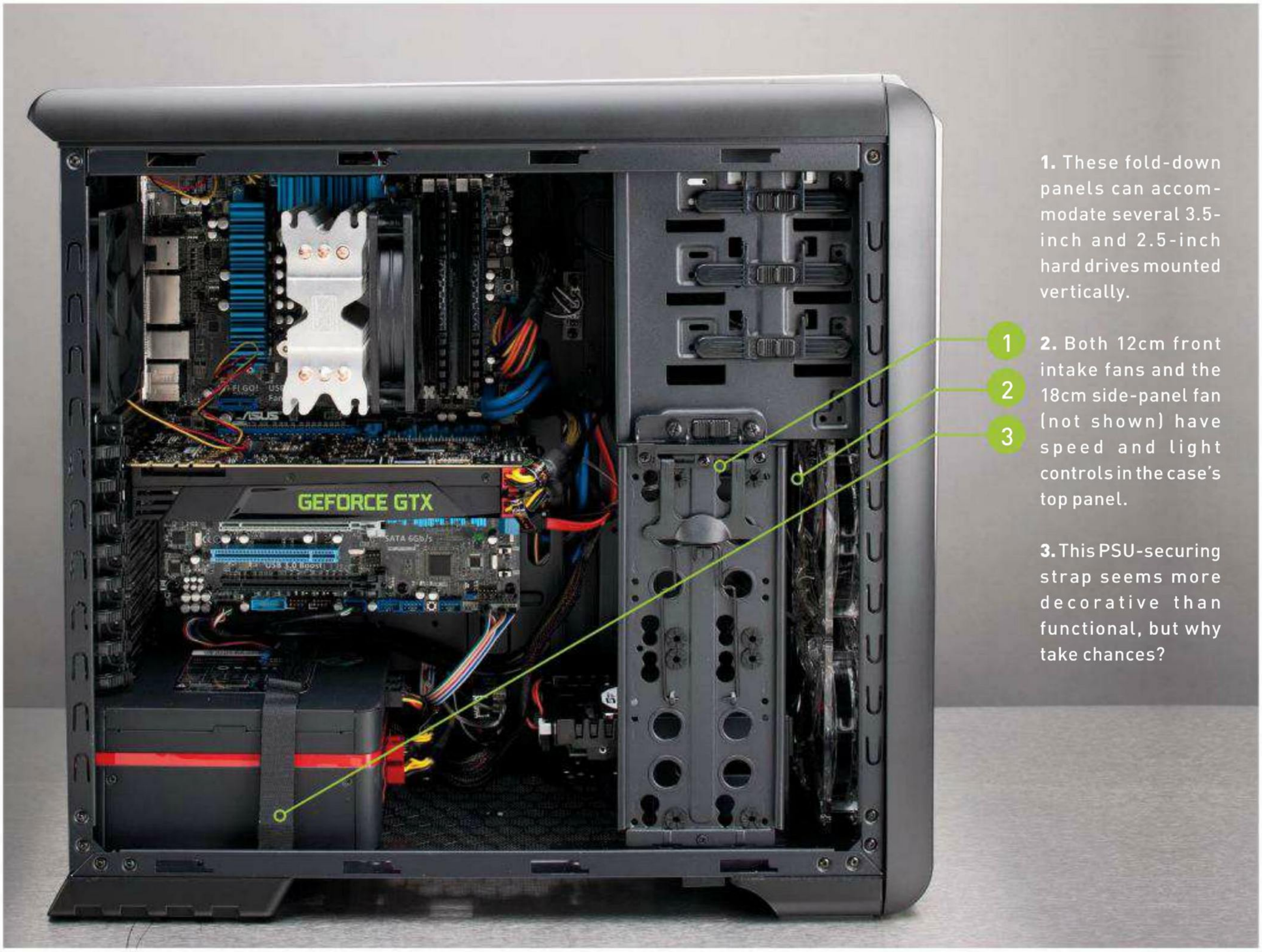
THE FULMO has two standard 3.5-inch hard drive mounts and several odd ones. I mounted the VelociRaptor into one of the standards using the screws provided for that purpose, but if you have more than two drives (or you want to use a 2.5-inch drive), you get to mount them vertically on flip-down mounting panels. You can see one flipped down in the foreground, and one in the upright position in the background **(image F)**. Connect SATA power and data to the drive, then install the optical drive in the topmost 5.25-inch slot and connect power and data to that drive, as well (not pictured).



7 BEHIND THE SCENES

BEFORE YOU TURN on the machine, don't forget to connect a 4-pin Molex power connector to the fan-speed controller **(image G)** and to the 4-pin connector coming from the case's front panel. If you've been careful, you'll now have a fine, somewhat cleanly wired gaming machine (see next page), but don't be surprised if the area behind the motherboard tray looks a little chaotic **(image H)**. The Fulmo isn't the best case for cable management, but it's workable. Now replace the left side panel.

Plug the right-side panel fan into the LED and fan-speed control panels, then put the right-side panel on, connect the PSU's power cable, and turn on your new Ivy Bridge machine!



1. These fold-down panels can accommodate several 3.5-inch and 2.5-inch hard drives mounted vertically.

2. Both 12cm front intake fans and the 18cm side-panel fan (not shown) have speed and light controls in the case's top panel.

3. This PSU-securing strap seems more decorative than functional, but why take chances?

THE IVY BRIDGE DIFFERENCE

IVY BRIDGE DOESN'T overclock as easily as Sandy Bridge or Sandy Bridge-E, but I was still able to get to an easy 4.2GHz by boosting the CPU's Turbo ratio in the BIOS, and I could have pushed it further if I had more time. Regardless, Intel's not joking about Ivy Bridge's prowess: This machine, with an Ivy Bridge i7-3770K at 4.2GHz, performed slightly better than our June 2012 Build It, which featured a Sandy Bridge-E i7-3820 at 4.4GHz. Clock for clock, Ivy Bridge wins.

We used the exact same GPU in both the Ivy Bridge box and the Sandy Bridge-E machine, and they performed the same in gaming benchmarks. No shock there.

BENCHMARKS

	ZERO POINT	
Vegas Pro (sec)	3,049	2,418
Lightroom 2.6 (sec)	356	258
ProShow 4 (sec)	1,112	887
MainConcept 1.6 (sec)	2,113	1,698
STALKER: CoP (fps)	42.0	62.6
Far Cry 2 (fps)	114.4	151.3

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our current desktop test bed consists of a quad-core 2.66GHz Core i7-920 overclocked to 3.5GHz, 6GB of Corsair DDR3/1333 overclocked to 1,750MHz, on a Gigabyte X58 motherboard. We are running an ATI Radeon HD 5970 graphics card, a 160GB Intel X25-M SSD, and 64-bit Windows 7 Ultimate.

To my surprise, the lack of an SSD didn't hurt me in the benchmarks, except perhaps in Sony Vegas Pro 9, where my machine lagged slightly behind last month's build. Windows doesn't load quite as fast, nor do game levels, but despite its lack of an SSD, this month's rig feels very fast. Granted, the VelociRaptor is a $300 mechanical 1TB drive, and the fastest we've ever experienced.

If you're building a gaming PC from scratch today, Ivy Bridge—specifically the Core i7-3770K—is the way to go, unless you think you'll want to upgrade to a six-core CPU down the line. But for $1,888 with a top-of-the-line graphics card, this Ivy Bridge machine is tough to beat on either price or performance.

worldmags

BUILD IT

GORDON MAH UNG **DEPUTY EDITOR**

Reliving the Commodore 64 Glory Days

How to build a modern-day PC into a replica of the world's bestselling computer

LENGTH OF TIME: **2 HOURS** | LEVEL OF DIFFICULTY: **INTERMEDIATE**

THE MISSION Many people wax poetic about the polite '50s, the radical '60s, or the wild '70s, but for nerds, the 1980s was the best decade. A full-on war raged in the new category of "personal computer," no one operating system ruled the world, and, man, you could walk into a Toys "R" Us and buy the world's all-time bestselling PC: the Commodore 64.

Whether you want to relive the golden age of PCs or you weren't alive for it, Commodore USA (no relation to Jack Tramiel's original Commodore International) offers its Commodore 64x to recreate that 1980s experience.

The main difference between the original C64 and this replica is the latter's ability to take standard PC industry components. Is the Commodore 64x case/keyboard a perfect recreation of the original? No, but it's damn close. I'm not judging this by my faded memories of the C64 I owned in 1982, either. See how closely the inset shot of the original resembles the new C64x?

Original C64

WHAT'S INSIDE THE NEW C64?

I HAD ENVISIONED using a Core i7-2600K with a notebook GeForce graphics card in the C64x, but I quickly realized that heat would be a serious issue in this thermally constrained PC, which has one puny 4cm fan handling all its airflow. I also considered a mobile Core i7, but the cost and scarcity of parts made me ditch that approach. In the end, I decided that an AMD E-350 Fusion APU would be the most cost-effective and reliable route.

The best candidate for the job? Zotac's Fusion ION-ITX T Series. The board features AMD's E-350 Fusion chip, built-in Wi-Fi, and, best of all, a 90-watt external power brick. Because the C64x doesn't have much room, running an internal power supply is out of the question. Pico-ITX PSUs are an option for standard boards, but that would require cutting a hole into the chassis to route the wiring. The Fusion ION-ITX T Series takes care of that in one swoop. Thermals also shouldn't be an issue with its integrated heat pipe and heatsink. My previous experience has taught me that the E-350 runs super cool for an 18-watt part.

For storage, I opted for Seagate's Momentus XT hybrid drive. It gives the C64x some SSD-like performance but is cheap enough that I can afford to give the machine 750GB of storage space. A Silverstone slot-fed DVD burner rounds out the package, but we did have to add an NZXT internal USB expansion module and an old-style Molex Y power splitter.

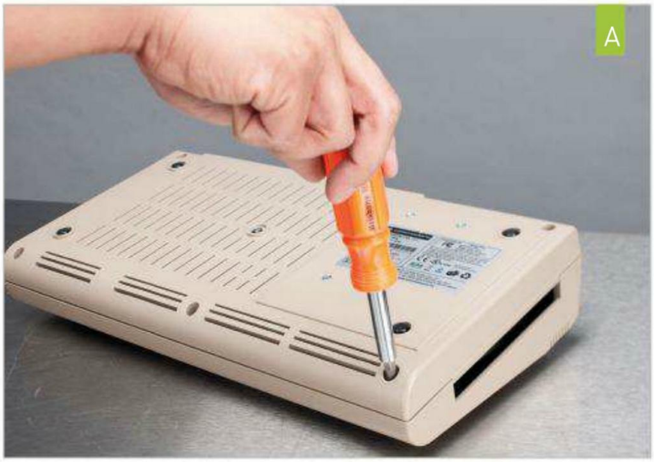
For tools, a standard Philips-head screwdriver and a small jewelers Philips-head screwdriver are required for the build. I also had to round up a set of system screws, as well as a set of screws that are typically used to mount an internal 5.25-inch optical drive.

INGREDIENTS

	PART	URL	PRICE
Case	C64x	www.commodoreusa.net	$345
PSU/Mobo/ CPU/Cooler/ GPU	Zotac Fusion ION-ITX T Series	www.zotac.com	$199
RAM	Corsair 8GB DDR3/1333 SODIMMs	www.corsair.com	$44
ODD	Silverstone SST-SO-D02	www.silverstonetek.com	$69
HDD	Seagate Momentus XT 750GB	www.seagate.com	$155
Miscellaneous	NZXT IU01 USB Expansion module	www.nzxt.com	$20
	One Molex Y-power splitters	www.newegg.com	$1
	Zalman Fan Mate 2	www.zalman.com	$7
Total Cost			$840

1 OPEN THE CASE

YOU'LL NEED TO unscrew six screws along the perimeter of the C64x first **(image A)**. Then carefully remove the keyboard and place it aside. Now, find a cassette tape player and put in your favorite mix tape of Olivia Newton-John, Survivor, Joan Jett, the J. Geils Band, and the Human League. Yes, all the top artists of 1982.



2 REMOVE THE DRIVE TRAY

UNSCREW the four screws under the C64x. Note: You will probably have to loosely hold the four nuts inside the case to get them loose. Once the screws are out, remove the tray and mount the 2.5-inch drive **(image B)**. The drive tray is countersunk to fit countersunk screws. Since Commodore USA doesn't include these parts (when they say bare-bones, they mean it), we used four fine screws of the type that comes with a 5.25-inch optical drive to hold the drive in place. This will cause the tray to ride a little higher than it should, but don't worry: The loosey-goosey build quality of the drive opening means the tray should still fit it. Mount the drive tray back in place and screw it into the case using the four screws and nuts.

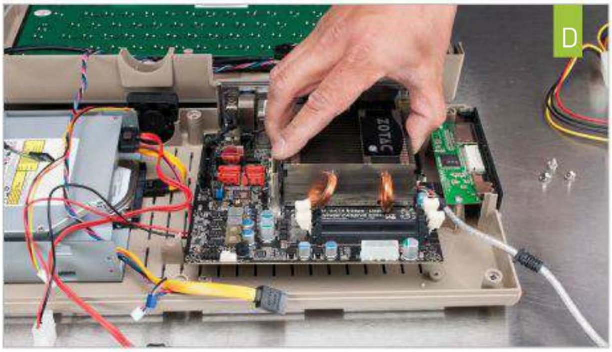
3 INSTALL THE OPTICAL DRIVE

WE COULDN'T FIND a 170KB 5.25-inch floppy drive, so we settled for this Silverstone slot-fed DVD burner. It comes with four tiny screws. Place the drive in the cage and screw it in place with the jeweler's screwdriver (image C). Now plug in the HDD power and SATA cable as well as the ODD power and data cable.

C

4 INSTALL THE ALL-IN-ONE MOTHERBOARD

INSTALL THE I/O shield by sliding it into the slots at the rear of the C64x. Now gently slide the Zotac motherboard into place, making sure the two Wi-Fi antennas feed out the holes in the I/O shield (image D). Take four screws from your spare parts box (because why would Commodore USA bother to include them in the box?) and gently screw the board in place (image E). The board doesn't have metal standoffs, so you'll be boring the screws into plastic. Do not over-torque the screws or you will strip out the mounts.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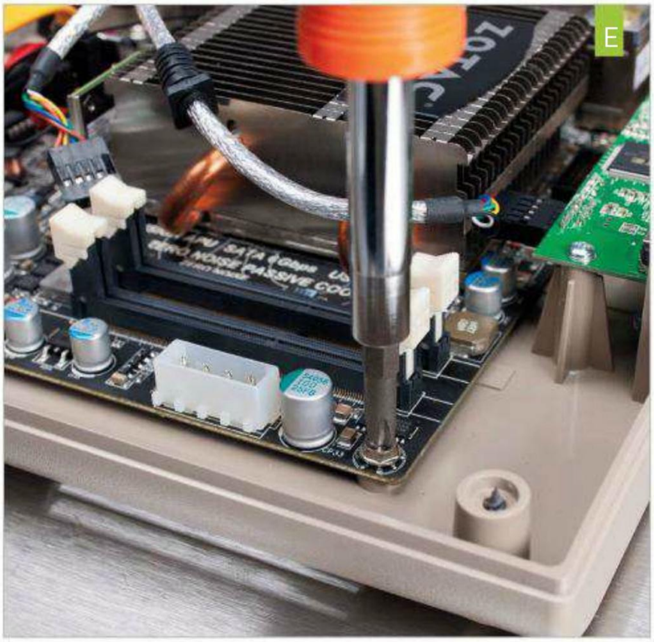
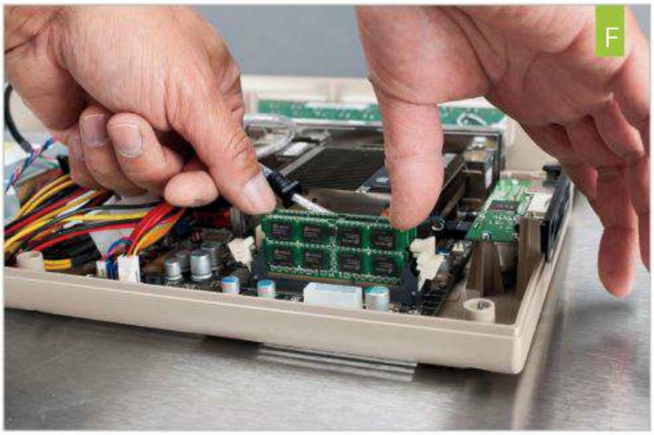

E

5 INSTALL THE RAM

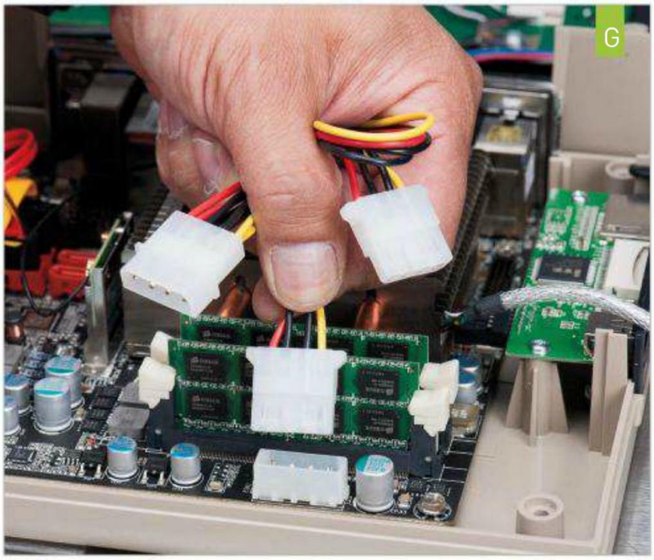
INSTALL THE PAIR of SODIMMs by placing them into the slots while carefully making sure the notches in the DIMMs line up with the notches in the slots. Apply pressure with your thumbs on the corners until the arms snap into place (image F).


F

6 EXPANSION NEEDED

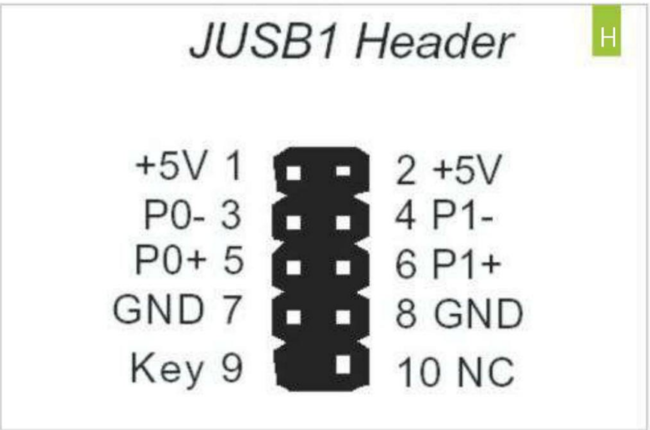
SINCE THE KEYBOARD is internal, it hooks directly into a USB 2.0 header. Unfortunately, the system's internal media card reader also requires a USB 2.0 header, but the Zotac board we selected has only one internal USB 2.0 header and a USB 3.0 header. To get around this, we used an NZXT 1U01 USB expansion module. The 1U01 needs power, so take the Molex Y-cable splitter and plug it into the Molex output on the motherboard **(image G)**. Now take the Molex-to-SATA power connector that came with the motherboard and plug it into one end of the Y-cable splitter. Plug the other end into the 1U01's power pass-through and then plug into the optical drive's Molex cable.

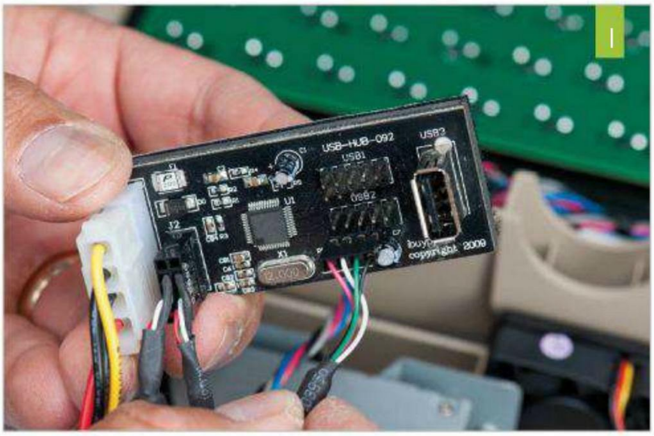
Windows 7's installer works fine with the NZXT 1U01 expansion module, but if the OS you're installing doesn't like it, you'll need to use a USB keyboard during the OS install in order for the installer to recognize your keyboard. Note that the expansion module shown in the photo is slightly older than the current 1U01, but the install is the same, and we tested with both units just fine.

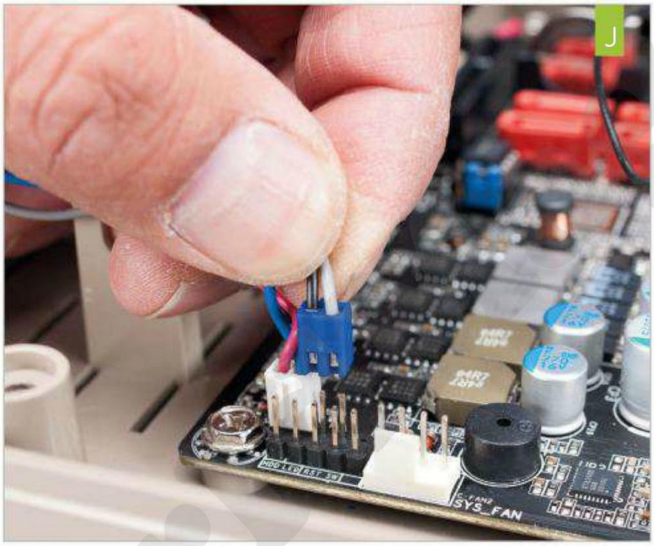


7 HOOK UP THE KEYBOARD

THE USB CABLE isn't labeled, but the wires indicate what functions they do. The red wire is power and the black is ground. Look at the USB pin-out chart we've provided **(image H)** and match the keyboard connector that has the red wire with one of the +5V pins and then plug it in **(image I)**. If you're still skittish, you can grab one of those USB header adapters that ship with MSI and Asus boards. Plug the power switch and power LED into the board's front-panel connectors **(image J)**.

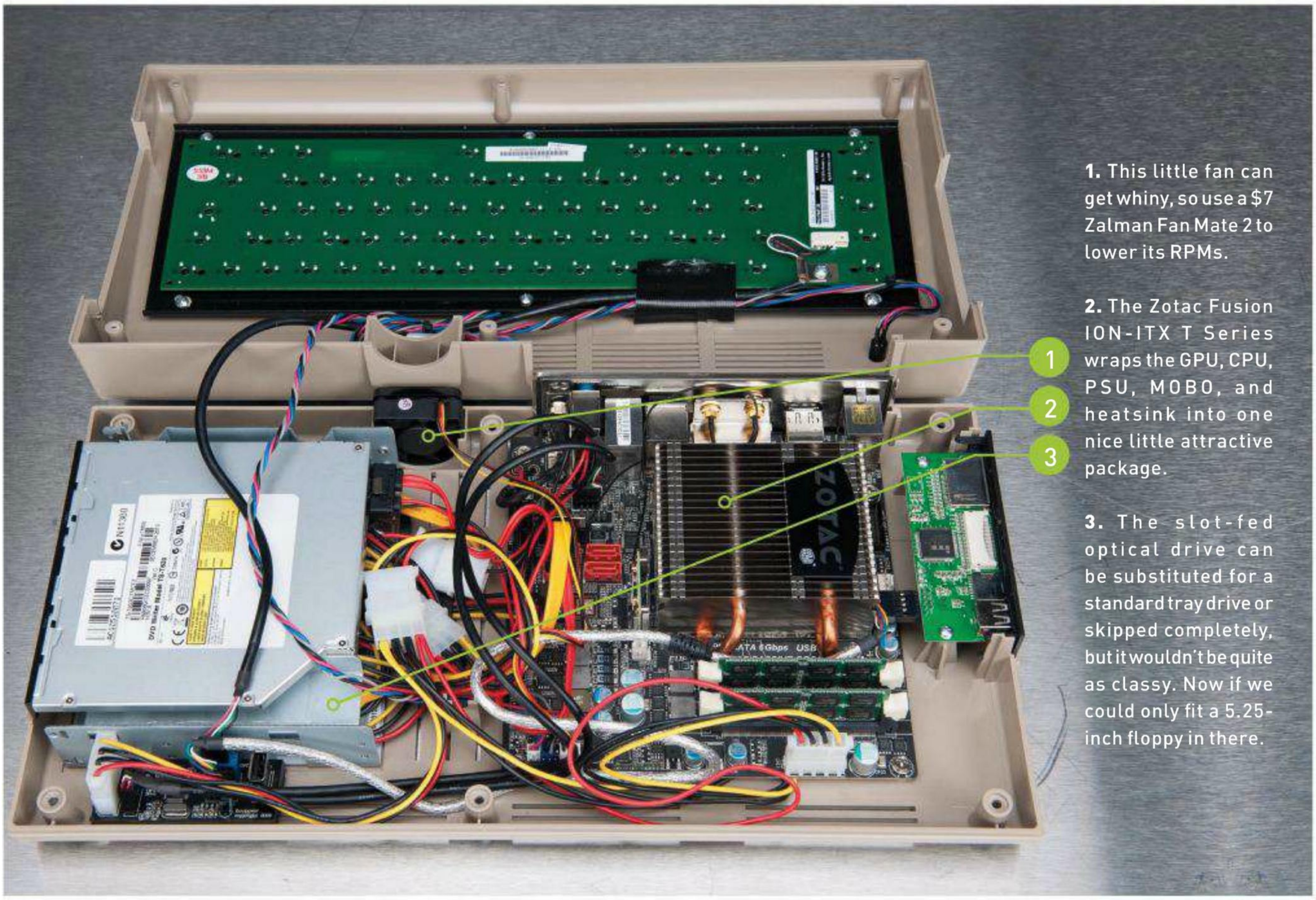






8 BACK TO THE FUTURE

YOU'RE READY to turn on the Commodore 64x. If you're wondering where the power button is, it's the red LED dome on the right-hand side.



1. This little fan can get whiny, so use a $7 Zalman Fan Mate 2 to lower its RPMs.

2. The Zotac Fusion ION-ITX T Series wraps the GPU, CPU, PSU, MOBO, and heatsink into one nice little attractive package.

3. The slot-fed optical drive can be substituted for a standard tray drive or skipped completely, but it wouldn't be quite as classy. Now if we could only fit a 5.25-inch floppy in there.

AN ELEGANT WEAPON FOR A MORE CIVILIZED AGE

THE ORIGINAL Commodore 64 packed a 1MHz MOS 6510 processor, which probably has one hundredth of the power of the CPU in your printer. Next to that, the AMD's E-350 "Brazos" would appear as magic from the gods. In our world, though, the E350 is pretty far off the power band as you can see from our tests. The E-350's main weakness is its x86 performance. The Fusion APU is faster than a dual-core Atom 330, but beefier parts such as Intel's Core i5-2430M—even with the i5's low clocks—will leave it in the dust. Where the E-350 in the C64x does well is in 3D performance—its integrated graphics solution has enough power to run older games such as Call of Duty 4: Modern Warfare at lower resolutions.

The real beauty of the E-350 is its low temps. At 18 watts for CPU and GPU combined, it really stays cool. In our experience, it's far cooler than Intel's own low-voltage 35-watt dual-core Sandy Bridge chips. The E-350 isn't about blistering performance, but neither is the C64x. It's about the cool factor of having a retro exterior with modern computer brains.

BENCHMARKS

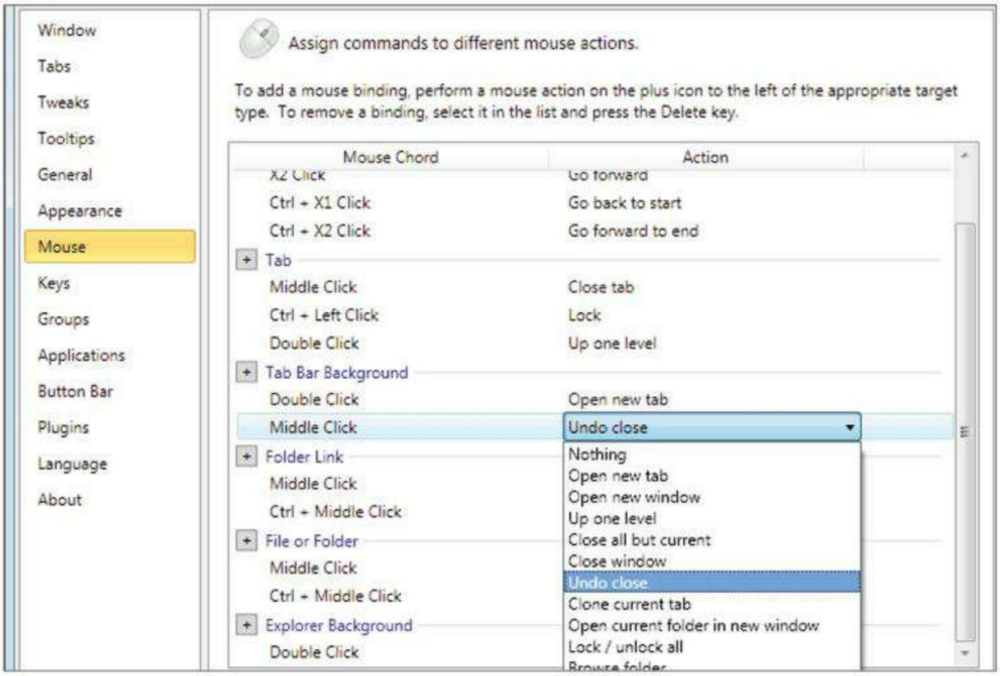
Model	Commodore 64x	Giada i50	Giada Ion-100	Zbox Plus Nano XS
CPU	1.6GHz AMD E-350	1.2GHz Intel Core i5-430UM	1.3GHz Intel Atom 330 w/ Nvidia Ion	1.6GHz AMD E-450
Photoshop CS3 (sec)	445	**272**	552	423
MainConcept (sec)	8,280	4,736	8,858	**4,560**
3DMark 2003	5,685	1,189	3,371	**6,954**
Quake III (fps)	**204**	87	118	161
Quake 4 (fps)	38	9	29	**40**

Best scores are bolded.

HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

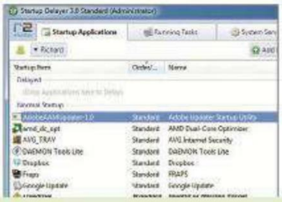
WINDOWS TIP



UPGRADE WINDOWS EXPLORER WITH QTTABBAR

Why is it that Windows Explorer—one of the most fundamental aspects of the Windows experience—has evolved more slowly than any other part of the OS? Force Explorer into the new millennium with QTTabBar, a mod package that adds tabbed browsing and tons of customization to good ol' Explorer.exe. It's in active development at http://qttabbar.sourceforge.net.

MAKE - USE - CREATE



56
Speed Up Boot Times with Startup Delayer

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Install Android on Your PC

ALEX CASTLE
ONLINE MANAGING EDITOR

THREE TYPES OF SLOW PC

WHEN I'M trying to figure out why a PC's running slowly, I start by grouping it into one of three broad categories:

Puny hardware: This is what us computer nerds always wish the problem was. Who doesn't love an excuse to buy some more RAM, after all? Easily diagnosed with dxdiag or the Windows Experience Index, it's the least common culprit.

Badware: Viruses and malware can cause the worst slowdowns, and are usually fairly easy to notice. Diagnose and remove with antimalware programs like Spybot Search & Destroy and Malwarebytes' Antimalware.

Just plain too much stuff: The most common and most frustrating cause, too many installed programs will slow your computer down even if they're not malware. Diagnose with hard disk visualizers (see last month's column) and the System Resource Monitor, and treat with CCleaner and Startup Delayer.

↘ submit your How To project idea to: comments@maximumpc.com

Speed Up Boot Times with Startup Delayer

YOU'LL NEED THIS

STARTUP DELAYER

This free tool lets you define a priority list of the order in which booting tools should be loaded into memory. It can load these utilities over a set amount of time or when it sees your machine isn't busy.
www.r2.com.au

PROGRAMS SHOULD know their place, sitting on your desktop silently and unobtrusively until called for. Instead, more and more of them try to run every time you load Windows, slowing your PC to a halt regardless of whether or not you want to check for updates, log into your games service, or whatever else they do.

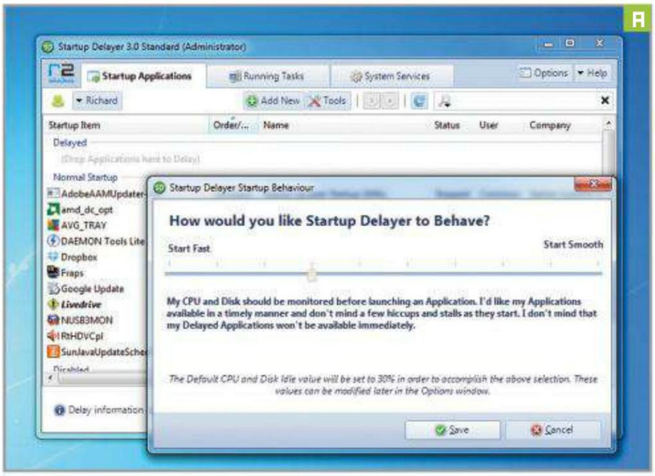
The more software you have installed on your machine, the more you'll notice the problem—to the point that there can be whole minutes between your desktop appearing and you being able to do anything with it. Luckily, there are ways to cut through all this. First we'll do a little spring cleaning. Then you'll find out how a tool called Startup Delayer can space out the applications you do want to load automatically, letting Windows handle them quickly, efficiently, and discretely behind the scenes.

1 MAKE MANUAL TWEAKS Boot your PC and, without loading anything, click the arrow icon in the system tray to see which programs load automatically. Right-click each one to bring up a menu that should explain what they are. Common apps include your graphics card Control Panel, software update checkers, and antivirus, but every PC will be different.

» Some programs, like antivirus software and Dropbox, need to be loaded and running, and can be left as they are. Other apps, like Steam, can be loaded when you need them. Right-click each of these and look for an option along the lines of "Run when Windows starts." If you don't see one, open it, and look in its Preferences/Options menu instead.

2 GET STARTUP DELAYER Open your web browser and visit www.r2.com.au to download Startup Delayer. Launch the setup file, letting it make a System Restore Point just to be on the safe side, and allow it to run. It will take a few seconds to scan your PC for applications and give you the option to load the help file. You can safely skip this part, at least for now.

» First, you need to tell Startup Delayer your priorities. These are based on a sliding scale that goes from loading your applications as fast as possible (all the way to the left) to only loading the next one when your PC is effectively sitting idle. As a starting point, we recommend going with the third or fourth notch from the left **(image A)**.

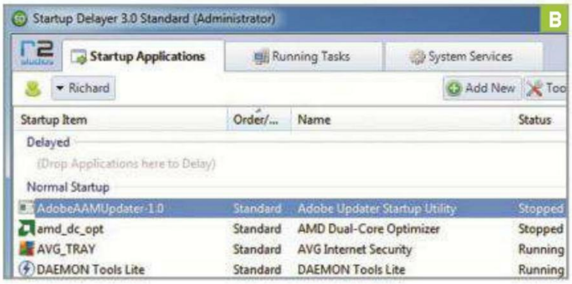


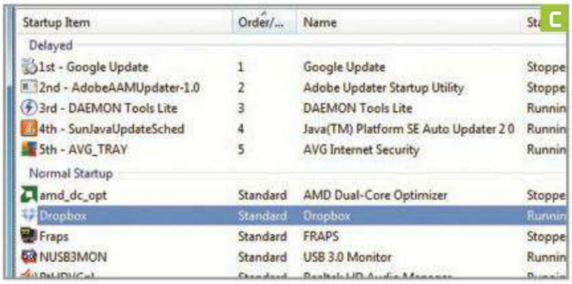
3 CONFIGURE YOUR LAUNCH ORDER By default, all programs are classed as Normal Startup, which means Delayer loads them as soon as possible **(image B)**. Essential software like antivirus should remain here, but the rest can be set as Delayed, meaning they wait until your PC is sitting idle. You can also drag apps into Disabled if you can't prevent them from loading automatically.

» Once they're in the Delayed list, you'll see that each application is numbered **(image C)**. This is the order in which Startup Delayer will load them when it finds a quiet moment. To reorder them, simply select one you wish to move, click on it, and drag it into its new position. Applications in the "Normal" list don't have a number, all being loaded at once.

» If necessary, you can take charge of individual applications by selecting them, then assigning either an automatic (based on how hard your processor/hard drive is working) or timed delay. Both of these options are listed at the bottom of the screen. You can also hold Shift or Ctrl to select and delay multiple applications at once.

» Restart your PC and see the difference. The more applications you had running the greater improvement you'll see, but any machine should feel noticeably faster.





Manage Your Desktop Workflow with Divvy

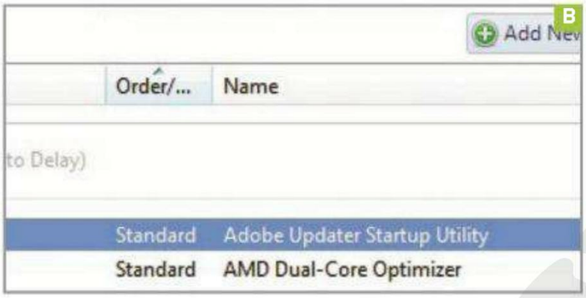
–Seamus Bellamy

ONE OF THE PROBLEMS with Windows is that in order to be productive, we're often forced to contend with a whole lot of, well, windows. It might be acceptable to minimize your Outlook and iTunes windows while you're cranking on a document in Microsoft Word, but if you're working on a small screen and need to constantly refer to research or source material as you type, juggling multiple open windows is a must. While clicking between open windows on your desktop might get the job done, it isn't all that efficient. Instead, we recommend using a window management program like Divvy. Originally it was only available to Mac users, but development house Mizage has finally seen the light, bringing its slick, easy-to-use brand of window management to Windows machines. To get started with Divvy, take the following steps.

1 DOWNLOAD AND INSTALL DIVVY Navigate to Mizage's website at www.mizage.com/#windivvy and download Divvy—available as a free trial (it's nagware) or to buy for $15. Click the application's installer .exe file and install the software to your computer.

2 GET COMFORTABLE WITH DIVVY Once installed, you'll be given the option to open Divvy; you can also hunt the program down in your Start menu and launch it. Once Divvy is launched, you'll be presented with a grid of squares representing your PC's desktop **(image A)**. If you accidentally close the Divvy grid, don't panic. You can reopen it by clicking on the Divvy icon located in your menu taskbar's notification area. Without clicking, mouse over the grid. As your mouse pointer passes over different areas of the grid, a corresponding area of your PC's desktop will be highlighted. By clicking and dragging your pointers across the grid, you can select multiple boxes.

» Click the cog icon in the top-right corner of the Divvy interface. You now have access to Divvy's preferences **(image B)**, which can be customized through options on three different panes: General, which allows you to set the application's startup behavior and shortcut settings; the Appearance pane, which allows you to tinker with the size allocated to each box on your Divvy desktop grid as well as the spaces in between each box; and Shortcuts, which allows for—you guessed it—the creation of user-defined shortcuts. To find out why, read on.



3 PUT IT TO WORK Now that you know the lay of the land, it's time to put Divvy to work. Open a windowed program, and then open the Divvy grid by clicking its notification center icon. To automatically change the size of the open window on your desktop, click and drag the space in the grid you'd like to see the window occupy. When you release your mouse button, Divvy will automatically resize your window. This process can be completed multiple times for multiple windows, making it easy to set up your desktop as a multi-windowed workspace **(image C)**. The process of hacking your windows down to size becomes even easier once you bring a few custom shortcuts into play.

» To choose a window size, open Divvy's shortcut panel, click New, and drag your mouse across the grid that appears. Next, choose a shortcut key for this window size and click Accept. Moving forward, the shortcut will be active any time you open the Divvy interface. To make the Divvy interface more accessible, users can turn to Divvy's General pane and set a custom shortcut there as well, all of which makes managing your desktop's open windows as easy as tapping on a few keys.

WorldMags

Install Android on Your PC

–Graham Morrison

YOU'LL NEED THIS

A SUITABLE PC
You can use any PC for pre-ICS Android, but you'll need a netbook or Intel-based machine if you want to try experimenting with Android 4.0 Ice Cream Sandwich.

USB STICK/VIRTUALBOX
You'll need the stick for some installations and VirtualBox 4.18 for others (www.virtualbox.org).

ANDROID
We're using the Nightly build of Android 2.2 from http://android-x86.moonman.dk, and the ISO image of 4.0.3 built for the generic platform from www.bit.ly/xwBkmY.

THE GREAT THING about Android is that it's open source, which means any developer can grab the code to Android and do what they want with it—and now you can, too. With a little work, you can get Android running on your PC right now, for free.

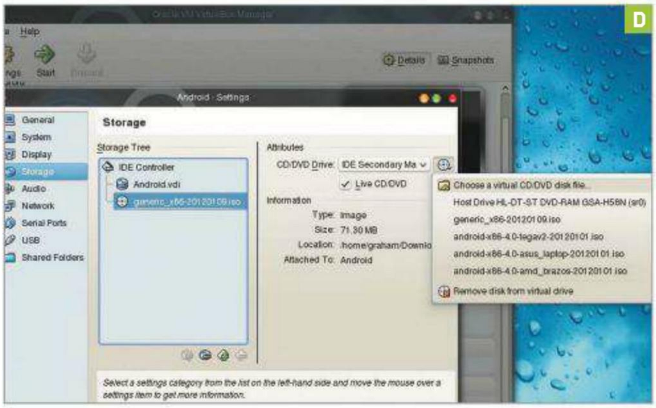
The main challenge is that most Android devices run on ARM processors, and porting it to run on anything else is a big challenge. Google does provide tentative support for the x86 architecture within the codebase, but it wouldn't be possible at all without the existence of a project called Android-x86 that pulls all this together with a considerable library of patches to create a build of Android that mostly works on Intel or AMD processors.

The project has been able to make earlier releases of Android run fairly stably on the x86 platform, including networking and mouse support. But the Ice Cream Sandwich version of Android still has some bugs running on x86, so we'll start by showing you how to install an earlier, more stable build on your PC.

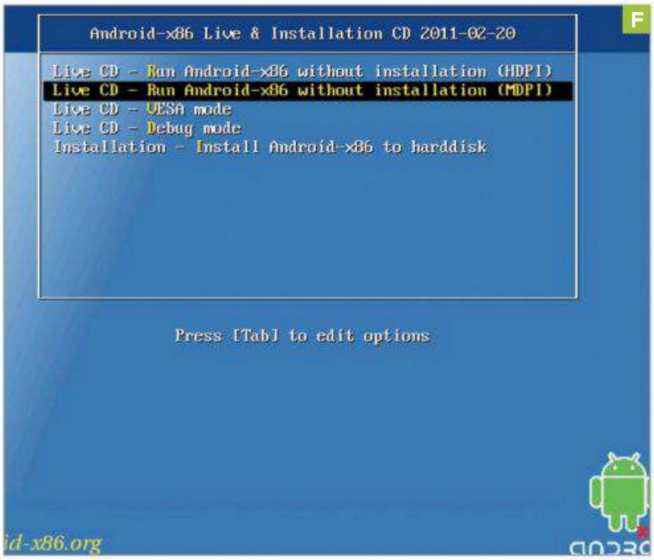
1 SET UP A VIRTUAL PC We'll take our first foray into Android by running an older version in a virtual machine environment. This is safe, maximizes functionality, and walks a well-trodden path. If you like it, you can move onto a newer version later. We used VirtualBox, though other virtualization programs should work, as well. Android works better on Intel hardware due to modifications in the source code, but we saw no difference on our AMD machine aside from a couple of warnings.

» We've had the best experience with the Nightly build of Android 2.2, which you can grab from http://android-x86.moonman.dk. With the ISO downloaded, launch VirtualBox and click the New button. In the wizard that appears, set the operating system to Linux, and set Other Linux as the version. We gave our machine 512MB of memory, and a 2GB hard drive as a VDI disk image.

» After the new machine has been created, select it in the machine list and open the Settings window. On the System page, switch to the Processor tab and make sure Enable PAE/NX is active for your CPU. Now click the Storage page. VirtualBox defaults to IDE emulation rather than SATA, and we need to add a second device to attach to our ISO image. If the device doesn't exist, click the controller followed by the "Add a new attachment" icon (which looks like an optical disc). A small window should appear asking you to choose a disc image, and you should point the resulting requester at the Android 2.2 image. If an optical drive already exists, select it in the storage tree. Use the disc icon on the far right to display a drop-down menu, then select "Choose virtual CD/DVD disk file" **(image D)**.



2 INSTALL ANDROID 2.2.1 Now that everything is configured **(image E)**, click OK in the Settings window, and then click the green Start button in the main interface. Android 2.2 will boot within the virtual machine. You'll see the boot menu **(image F)**, from which you should choose the first option. HDPI and MDPI refer to the screen resolution of the output device, which you can ignore when running on anything other than a tablet. If you decide to try this boot on real hardware, then the third option avoids graphics drivers by using the VESA mode. This is useful if you run into compatibility problems. If you like what you see with Android, the final option will create a permanent installation on a spare drive partition. A few moments after making your choice, you'll see Android's unlock screen. The final hurdle is overcome by pressing the right Ctrl key and selecting "Disable mouse integration" from the Machine menu. Now when you click the virtual machine, you should see the mouse and be able to slide the padlock icon up to enter the OS.



UPGRADE TO THE REAL DEAL Hopefully you've now played with Android 2.2 and want to upgrade to the latest version. We'll show you how to install the Ice Cream Sandwich Android build on your PC, without virtualization. But before you can begin, you'll need to go to the Android-x86 Project's homepage and download the most recent Ice Cream Sandwich build (also known as Android 4.0.3) compiled for generic x86 hardware.

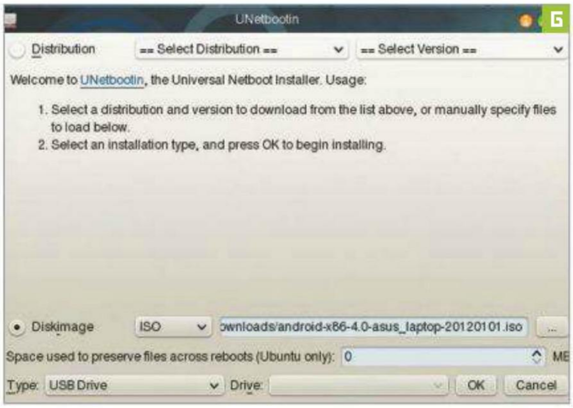
» You can either burn the Android ISO file you downloaded to a CD or onto a USB stick, which can then be booted on the machine. If you want to create a bootable disc, you'll need to download UNetbootin, which you can download at http://unetbootin.sourceforge.net.

» First, insert your USB stick—1GB will do. All the data will be lost, so make sure there's nothing on there you want to keep, then launch UNetbootin. The top half of the window is used for selecting a Linux distribution, which can be downloaded and installed automatically. We want to use the bottom half to locate the ISO and ensure the correct USB device has been selected **(image G)**. If everything is correct, click OK. This will start the conversion and begin to write the bootable data to your USB stick. It should complete in a few minutes.

» Like a live Linux distribution, Android can now be booted by turning on your machine with the CD or USB device inserted. As long as the BIOS or boot menu is configured to probe the right device first, you should see the Android boot menu. This has three options, with Default being added by UNetbootin. Choose the first, "Run Android x86 without installation," to test the OS. If everything works, you can choose to install at a later time. Android takes a few minutes to boot. After the Android logo, you'll see the starter wizard. This is where, on a real device, you sync the hardware with your Google account, but without network connectivity it makes no sense. Just click through the options to get to the OS quickly.

» You'll now see the start page of Android. This adds a few prompts to help you get started, but Android is easy enough to use without any prior experience, especially if you tried version 2.2.3 earlier. The main differences are in the transitions and how the display looks, but all that can be changed, too. Applications are launched from the small matrix icon on the top right, and you can use the arrows in the bottom left to move between what Android calls "activities." In normal terms, these are virtual desktops.

» Playing with the settings is the first thing you should do. You can get to the Settings panel **(image H)** by clicking the clock in the bottom right of the display, then on the text that says "No Internet connection." Clicking the Wi-Fi icon will turn it on, and hopefully you'll be able to scan for networks with the Scan button at the top of the screen. Again, Android on x86 is still a work in progress, so features like networking may not work with your hardware. If you encounter problems, remember to check back soon—the project is updated frequently.



WorldMags

Personalize Facebook Timeline

–Tamsin Oxford

YOU'LL NEED THIS

A FACEBOOK ACCOUNT

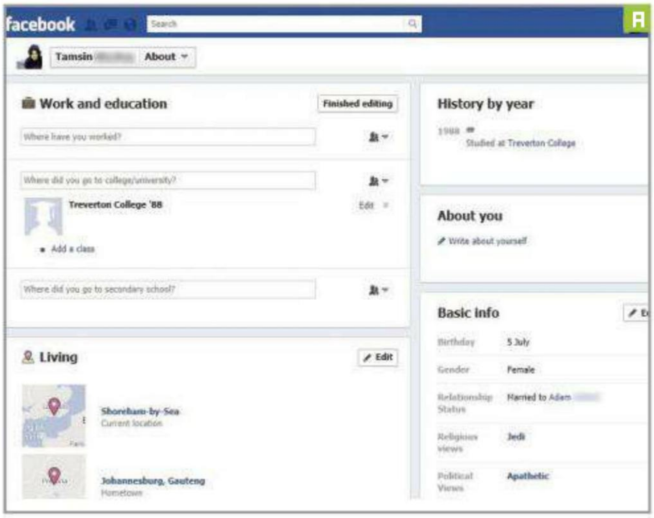
Without this, you have no history of posts, pictures, videos, and other remembrances for Timeline to work with.

TIMELINE

To get started with Timeline, go to www.facebook.com/about/timeline and click Get Timeline.

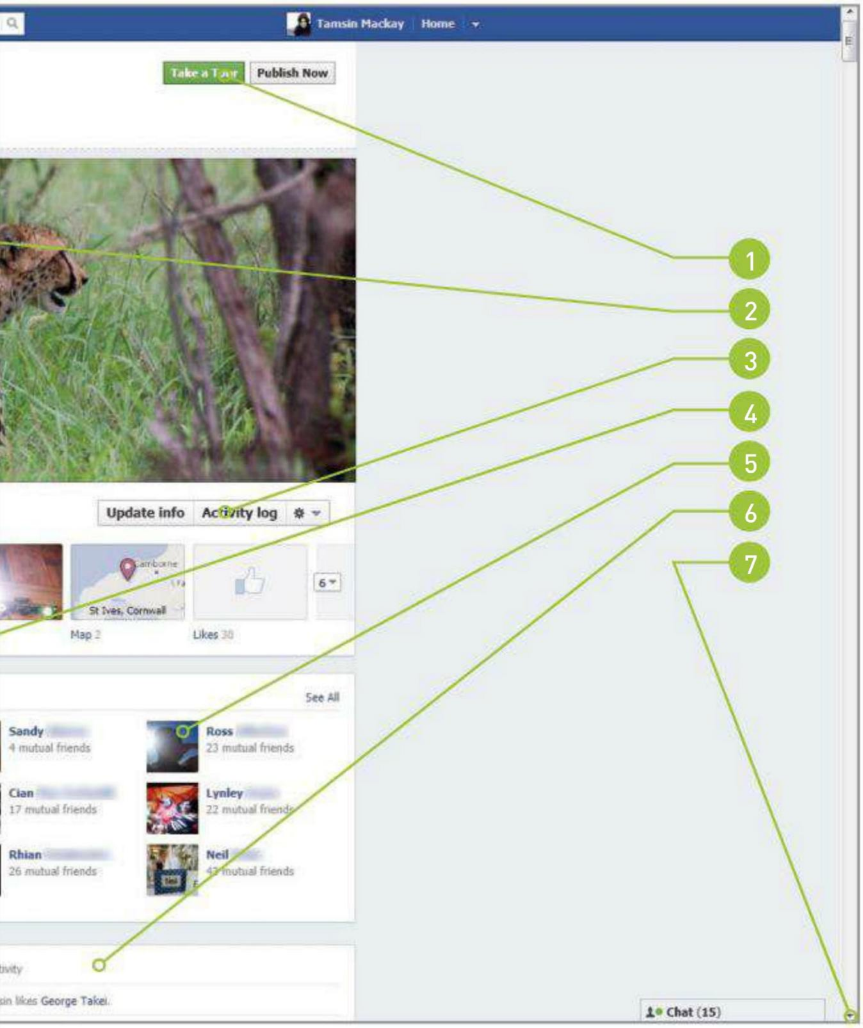
FACEBOOK'S LATEST feature, Timeline, will transform your profile page into something more like a personal movie or epic book. The new layout gives you the chance to unleash your creative talents and allows you to view your past images, notes, special moments, and status updates in one continuous stream. From here you can see what you were thinking, doing, and saying as far back as when you first joined Facebook. The entire feature is geared toward providing memories in a stunning visual format that will last for years.

It's also a lot of fun to set up and manage, but once you've chosen to go ahead and install it, there's no undo option and you have to complete it in seven days before Facebook makes it live to the public.



1 PICK A COVER Once you've installed Timeline, you'll be taken to your profile, where you'll see a big space at the top. This is for your cover photo, which you can select yourself. The size of your cover is 851x315 pixels, so choose a high-res image that won't distort or stretch. Click the Add a Cover icon at the top of the page, and choose to Upload a New Image or use one already in your Photos.

2 UPDATE YOUR INFORMATION Click the Update Info icon below the cover image. You'll be taken to your personal info page, which is far more detailed now that you're using Timeline. You can add in History by year, where you're living, your work and education details, and more. This information will be used by Facebook for advertising purposes, so keep it minimal if that bothers you.



1 TAKE A TOUR When you first get Timeline you can take a detailed tour of the various features that will show you how to get started with reading your stories and adding information. This is also where you can publish your finished Timeline for the world to see.

2 COVER PHOTO The cover photo is enormous and is the first thing anyone will see on your new Timeline page. Make sure you use a high-resolution image so it looks bright and crisp. You can change this at any time by hovering your mouse over it. Your profile pic appears on the left.

3 ACTIVITY LOG You can click either Activity Log or About to be taken to a page that shows a complete list of all your latest activities. This page is completely private—nobody else can access this information.

4 ADD EVENTS When you click Life Event you'll be able to choose from five different sections, each with suggestions and ideas for events to add to your Timeline. You can add as many as you like and as much detail as you want.

5 FRIENDS Now you can instantly see a complete list of all your friends just by clicking the See All icon at the top-right of this box.

6 RECENT ACTIVITY Below the Friends box you'll see a list of your recent activities, which provides an instant glance at what you've been up to lately.

7 THE TIMELINE Scroll down the screen to see every year and all the things you've been up to in that year. Facebook has automatically put all the different updates, images, and activities into their relevant spots for you. You can use stars to give certain events and stories prominence.

3 CHRONICLE YOUR LIFE EVENTS

Back on your profile page, on the left-hand side you'll see a column with four headings: Status, Photo, Place, and Life Event. Click Life Event. Here you can fill in information about important events in your life that will get priority on your Timeline. These can be anything from graduating college to having a child.

4 SET PRIVACY CONTROLS

Congratulations, you've now customized your Facebook Timeline! Remember, everything you add to your Timeline can be made private by selecting the drop-down menu beside the Public icon. You can choose Friends, Custom, or more specific options you've created. To keep your Timeline private, make sure you adjust these every time, since the default is Public.

Create a Windows 7 System Repair Disc

–Mike Williams

YOU'LL NEED THIS

OPTICAL DRIVE
You can't burn a repair disc without one.

RECORDABLE MEDIA
Your repair data can reside on either CD or DVD discs.

THE WORST MOMENTS of our computing lives revolve around the same situation: You've turned your system on, and Windows, for whatever reason, won't start.

Has your computer turned into so much useless metal? Have you lost everything? It's a horrible feeling.

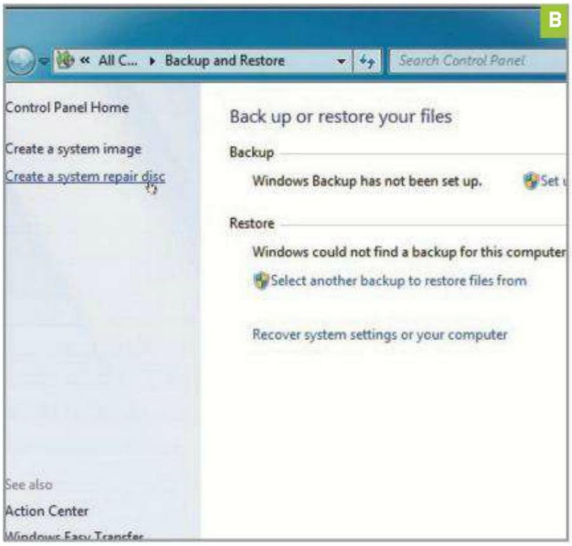
Fortunately, there's a simple solution: With a Windows 7 installation DVD, a Repair function could get your PC booting again in next to no time. But if you don't have an installation DVD—and many of us don't these days—or if it's lost or scratched, you'll be in trouble. That's why you need to prepare for disaster before it happens.

Follow our simple guide and you'll have a Windows 7 system repair disc, which you can use to start an unbootable PC—and usually get it working again—in about 10 minutes.

While you're pulling out that spindle of recordable DVDs, we'd also like to suggest another option for disaster recovery: ghosting your drive. Making a bit-for-bit copy of your hard disk might seem a bit extreme, but it's worth doing on a new-ish PC, just so you can always restore it to its default state. We use Macrium Reflect Free's clone facility (www.macrium.com/reflectfree.aspx).

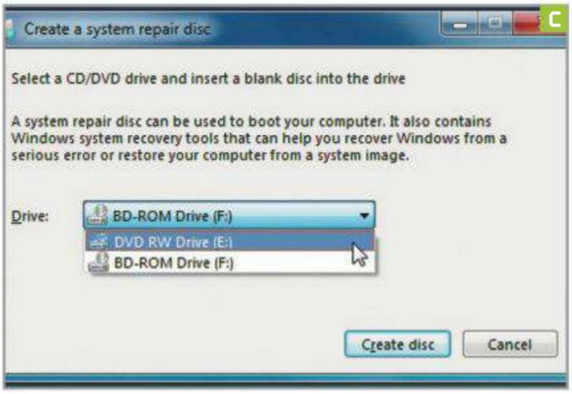
1 LAUNCH THE DISC CREATOR Click Start, then select the Control Panel option. If the View By option is currently listed as Category, click the arrow to its right and select Large Icons so you can see all the available Control Panel applets on one screen **(image A)**. Find the Backup and Restore applet and double-click to launch it. This is where the magic happens.

» Click "Create a system repair disc" on the left to run the tool that you need **(image B)**. If you don't see this option, you can also launch the repair disc tool as a separate entity. Simply click Start again, type recdisc into the Search box, and then click the recdisc link or hit Enter to fire up the program you need.



2 BURN A DISC Locate a blank disc—it doesn't really matter whether it's a CD or DVD, although we recommend a DVD in case the process decides it would like more space. Place the disc into one of your optical drives. Then click the arrow to the right of the currently selected drive, in the "Create a system repair disc" program, and choose the drive that contains your disc **(image C)**.

» Click the Create Disc button, and the program will burn the system recovery files to your CD or DVD. This shouldn't take long—on our computer, with

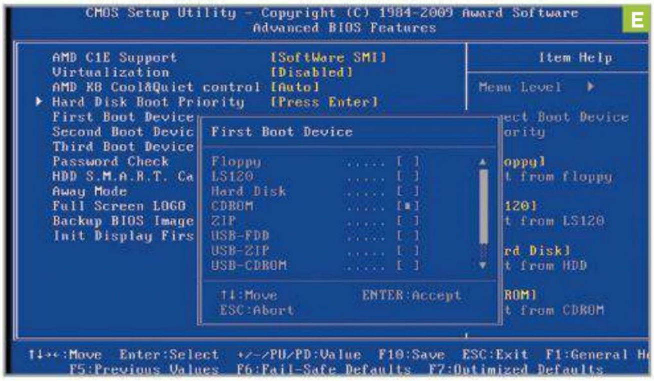


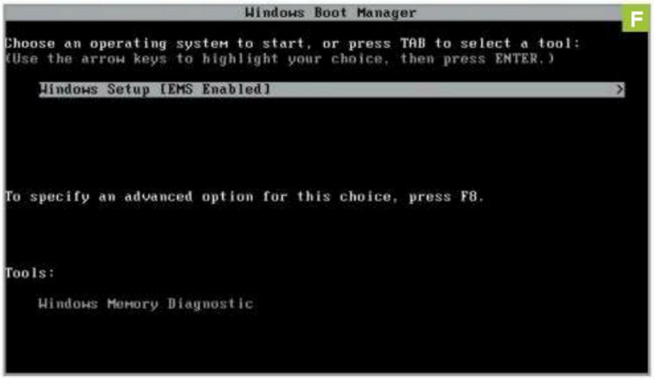
3 TEST THE DISC Test your disc immediately to make sure it works—it only takes a moment. Leave the disc in the drive, close any open applications, and reboot your PC. If Windows loads as normal, you need to change your BIOS setup program to boot from your optical drive first **(image E)**. Check your PC's manual for more advice; there's a specific key you'll need to hold while booting.

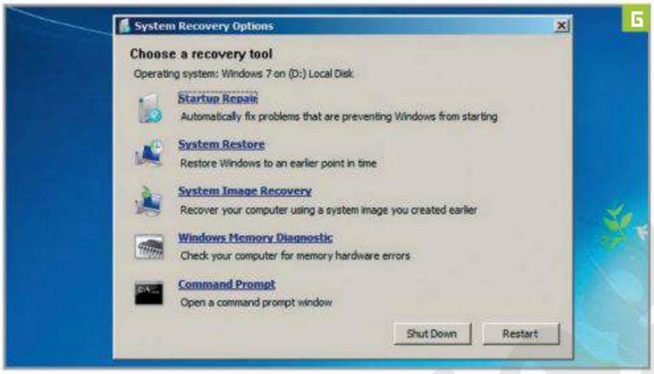
» When your computer is booting from your repair disc correctly, you may see a message onscreen prompting you to "Press any key to boot from CD or DVD." If you do, the repair disc will continue to load. Then you need to choose the option Windows Setup [EMS Enabled] from the menu **(image F)**.

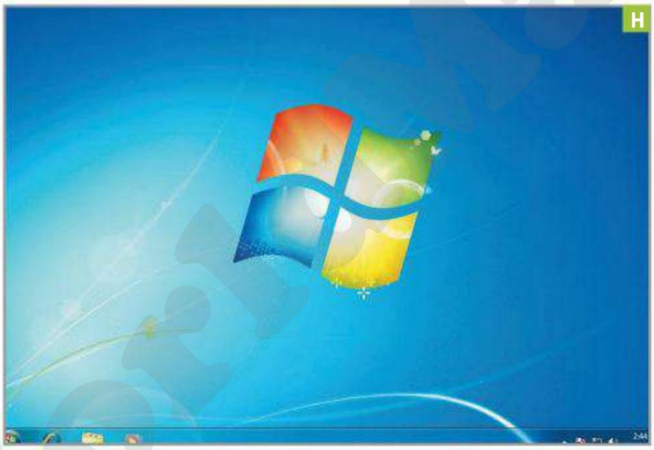
» Select your keyboard and click Next. Select your Windows installation, then

» Next again, and you'll see the recovery options. If you ever find that Windows 7 won't start, boot from this disc, click Startup Repair **(image G)**, and Windows should get your computer working again, automatically **(image H)**.You now know all about the Windows 7 Recovery Disc creation tool. If you've completed these steps, well done—you're protected. Even if Windows 7 won't start, you can always launch the Recovery Disc, then use System Restore, a backup, or Startup Repair to fix the problem and get everything back to normal.









Access Your Media Remotely with Remote Potato

–Nick Peers

YOU'LL NEED THIS

MEDIA

Should go without saying, but if you want to stream media, you'll need a collection of digital media files to stream.

REMOTE POTATO SERVER

Get this media streaming software at www.remotepotato.com.

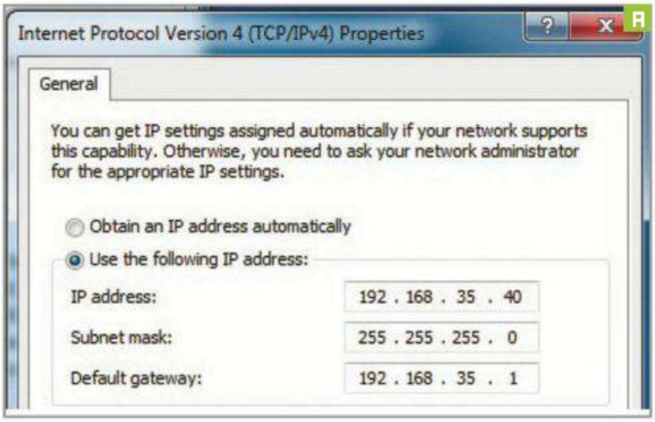
WINDOWS MEDIA CENTER is the perfect central location for all your media: music, photographs, video, and recorded television shows. Its main drawback is that all that media is tied to your home computer.

Remote Potato is a free program that lets you access all the media stored in Windows Media Center on your home computer from another location. You can access it over your home network or—via the Internet—from outside your home on a computer or smart mobile device using its web browser or a dedicated app.

And not only do you get access to your home computer's media collection, Remote Potato lets you remotely set up and manage your TV recordings while you're out, too, which is perfect if you're stuck at work and worried you'll miss your favorite show.

1 INSTALL REMOTE POTATO SERVER Install Remote Potato Server from www.remotepotato.com onto your home computer running Windows 7 Home Premium or later, with Windows Media Center already set up and configured. When prompted during the setup process for Remote Library Access, enter your Windows username and password to gain access to your music library **(image A)**.

» Follow the rest of the setup prompts; once complete, click Close. After a short pause, the server will automatically start and a wizard will guide you through the initial setup process. Start by ticking "Yes, enable security" and providing a username and password, which you'll use each time you wish to access your media remotely.

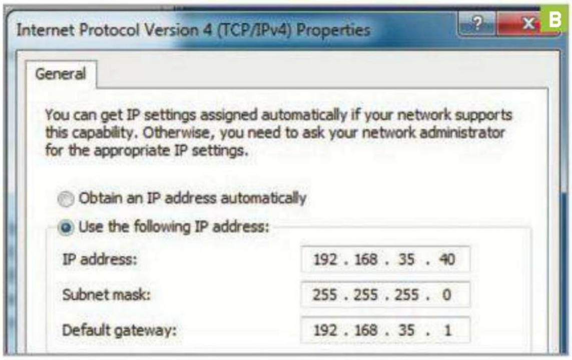


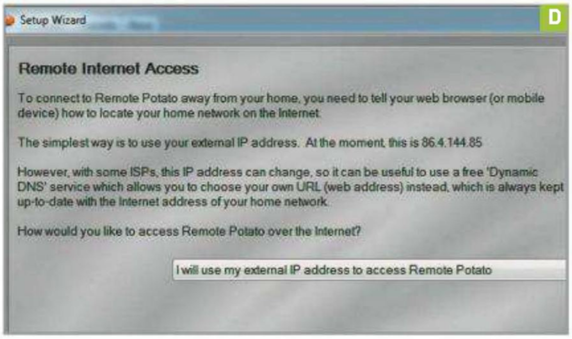
2 CONFIGURE THE SERVER You need to assign your PC a static IP address **(image B)**—see bit.ly/static-win7 for a simple step-by-step guide to doing so. Next, consult your router's documentation or visit www.portforward.com to learn how to access your router's configuration utility. This is typically done by typing the router's IP address into your web browser.

» Once logged in, look for the Port Forwarding section. Follow the instructions to add two separate port forwarding rules, as instructed by the Remote Potato setup wizard: Enter the port or port range into the appropriate boxes, and enter your computer's static IP address, too **(image C)**. Make sure the rule is enabled, and click Apply.

» Return to Remote Potato and complete the wizard—leave "I will use my external IP address to access Remote Potato" selected and click Next **(image D)**. The final screen reveals how to access your media server via another computer, either over your internal network or over the wider network. Make a note of these settings and click Close.

» Next, click No when prompted about the iPhone app. Click the Settings button to reveal a selection of options: Choose what media to share in the General tab **(image E)**, then tweak your television channel settings through the TV Guide and Channel tabs. Once done, click the Play button to start the server, which is now ready for action.





3 ACCESS YOUR COLLECTION REMOTELY

Open a web browser on the other computer and type in http://0.0.0.0:9080, replacing 0.0.0.0 with the static IP address you created in step two. Press Enter and if necessary install Microsoft Silverlight, following the instructions to ensure the best-quality access to your media. Enter your username and password to log on.

» Click Yes if prompted by Silverlight to increase storage. Select what type of content to access from the main menu—music, pictures, recorded TV programs, video, and movies—then browse the folders to locate individual files **(image F)**. View or listen to single files, or use the controls to set up playlists or watch picture slideshows.

» If you record TV on your PC, you can schedule new recordings as well as configure existing ones directly from your web browser—perfect if you've forgotten to record a favorite show, for example. Select TV Guide from the menu to browse for shows to record **(image G)**, or click Scheduled Recordings to manage recordings set up previously.

4 GET MOBILE ACCESS

You can access your media through your smart mobile device via its web browser **(image H)** or a dedicated app (search its app store). There's Smart Potato for Windows 7 phones ($2.49), Remote Media Center (free) for Android, and Remote Potato/Remote Potato HD ($6.99) for iPhone and iPad.

Measure Your Online Influence with Klout

–Rachael D'Cruze

YOU'LL NEED THIS

SOCIAL MEDIA ACCOUNT
You don't have to be a social media maven to use Klout, but you will have to have at least one account with a social media service like Facebook or Twitter in order to get a score.

WHILE WE'VE ALWAYS had the power to influence other people, that power, which is being democratized, is much easier to harness with new social media tools. But how much influence do you have over others? Do your Facebook "likes," retweets, posts, and comments go unnoticed, or are you an online mover and shaker? This is where Klout comes in, measuring your influence based on your ability to drive action in social networks, and providing you with an updated Klout Score each morning.

Klout provides insights to help you better understand your own power—whether others trust your opinions online, what topics you're the most influential on, and how you compare with your friends. Your Klout Score measures your online influence on a scale of 1 to 100, but the average Klout Score is 20, not 50—bear that in mind when you get yours.

1 GET KLOUT AND ADD NETWORKS Head to www.klout.com. You'll see "Sign in with Twitter" and "Connect with Facebook" buttons **(image I)**. Click either of these to log in.

» A pop-up screen will now appear. Check the "I'm an individual influencer" button and type in your email address, as requested. You are now signed up to Klout. Click "I'm ready" in the new window, and let the narcissistic fun begin.

» To get the most out of Klout, add all the social media sites that you tend to use **(image J)**. Make your way through the social media icon buttons, which simply prompt you to sign in and give Klout permission to access your information. If there are some listed that you don't use, you don't need to click on them.

» When you are finished, click Continue.

2 EXPLORE YOUR SCORE You'll now be shown a range of your friends and followers from Facebook and Twitter. You can invite them to use Klout through the invite button, or skip this step. When you're done, click Continue and in the pop-up window you'll see your Klout Score **(image K)**. Click the buttons underneath to share your score, using your various social media accounts.

» You'll now be taken to your Klout dashboard **(image L)**. Click the red "View your profile" button. At the top of your profile you'll be able to see how many people you influence through social media and what topics you are influential on. Look further down the page for an analysis of your Klout Score. As we said before, don't be too disappointed if it's in the region of 20.

» So, what does your Klout Score actually mean in terms of your social media presence? Your Klout Style will explain everything. Click the Klout Style link on the left-hand side of the homepage. On the

chart you'll see where you fit and get an explanation of your current Klout Score **(image M)**. It's great for seeing how your friends and followers fare, too.

3 GET PERKS Klout automatically pulls your About text from Twitter.

» If you want to change it, choose Settings in the drop-down menu on your home page. You can type in an alternative profile, add your gender and birthday, and change your profile picture **(image N)**. Joined more social media sites? Click "Connected networks" and tell Klout about them, as well, to help them track your score.

» From the drop-down menu in the top right of your profile page, which is accessed by clicking your name, choose Perks **(image O)**. Klout Perks are exclusive products and experiences that you earn based on your influence, which of course is measured by your Klout Score. Explore the perks to see if anything strikes your fancy.

» You've now successfully come to grips with Klout and discovered how much online influence you have in your combined social media networks. As your online presence grows, your Klout Score will increase in accordance and you'll have earned more perks **(image P)**. So don't forget to check back regularly to see what goodies you've earned.

WorldMags

Add a Padlock to External Drives

–Nick Odantzis

YOU'LL NEED THIS

CONSEAL

This software will encrypt your USB hard drives and let you remotely destroy the data they contain if they fall into the wrong hands. Get it from www.consealsecurity.com.

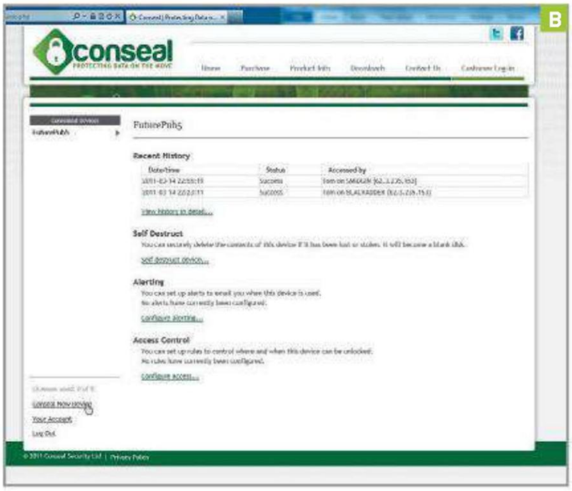
PORTABLE HARD DRIVES are convenient, but there's always the risk of one being dropped and lost somewhere. Then what happens? Someone spies your shiny-looking device lying around, picks it up, and decides to have a look at everything on it. If you've got confidential documents saved, they could fall into the wrong hands.

To prevent this you need to encrypt your drives, ensuring that only you can read what's on them. It sounds tricky, but it isn't—Conseal does all the work for you. There's a trial at www.consealsecurity.com. Bear in mind that the trial is active for 15 days, and the full version, which encrypts up to five drives, is $30.

1 TO BEGIN, INSTALL THE FREE TRIAL You'll need to enter your email address, and then check your inbox for a message containing your password. Head back to the Conseal site and click Customer Log-in. Type your email and password **(image A)**, and then click Log in to access your Conseal management console.

» Start protecting your USB drive by clicking "Conseal new device" in the menu on the bottom-left **(image B)**. The software that you need in order to encrypt the drive will begin downloading, so save this to your PC and double-click to install. During the installation process, you'll be asked to enter your login details once again.

A

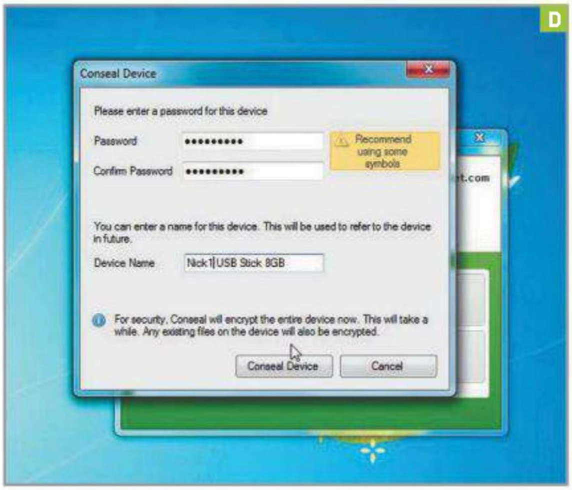


B

2 ENCRYPT YOUR DRIVES On the next screen you'll see a list of all the USB drives connected to your PC. Only the drive letter will be listed, so if you're not sure which drive you are Consealing, go to Start, click Computer, and open the drive to check it. Now, simply click Conseal This next to the name of each drive currently connected to your computer **(image C)**.

» When you click Conseal This, a new window will appear asking you to give a password for the drive you're Consealing **(image D)**. Enter a password, and then enter it again for verification. Give the device a distinctive name so you can quickly distinguish it from other similar drives on the website, and click Conseal Device to begin encryption.

» Click OK when you're asked to install the Conseal security component—this only needs doing once for each drive. Click Yes when a security prompt appears, and then go make a cup of tea. The encryption process can take between 10 minutes and a couple of hours to complete, depending on how big the drive is **(image E)**.

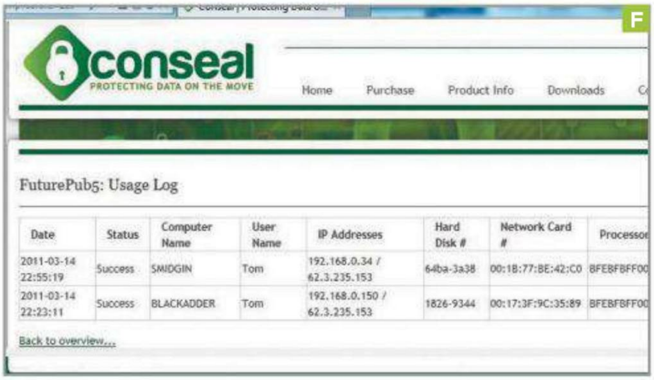


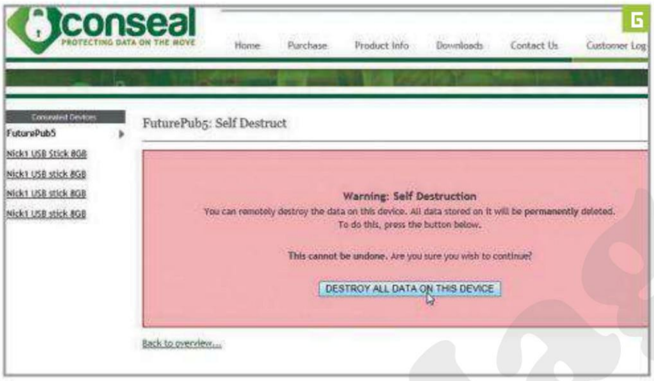
3 MANAGE YOUR DRIVES

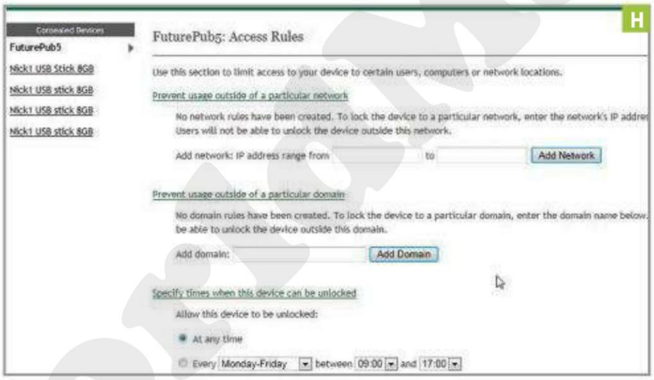
MANAGE YOUR DRIVES When this is finished, your drive will be password-protected, so only you can access the documents on it. Should you lose it, there's the option of destroying it remotely, but before you do that, check to see if someone else with access has used it—click "View history in detail" in the Management console **(image F)**.

» If you're sure it's fallen into the wrong hands and someone has attempted to unlock your USB drive, you can destroy it from your desktop. Simply go to your customer login and sign in, then select the lost device and click "Self-destruct device" **(image G)**. This will render the drive unusable, but don't take this step lightly—you'll never be able to get it back.

» You can rest easy now that you know how to encrypt your USB drives and destroy them remotely if the worst happens. If you want to give other people access to your protected USB drive, simply select the device from the Management console and click Configure Access to add them to the Allowed Users list **(image H)**.







WorldMags

Use Amazing Video Backgrounds

—James Stables

YOU'LL NEED THIS

VIDEOS
You can use your own creations or download pre-made files. The video should be brief, and of high enough resolution to look good onscreen.

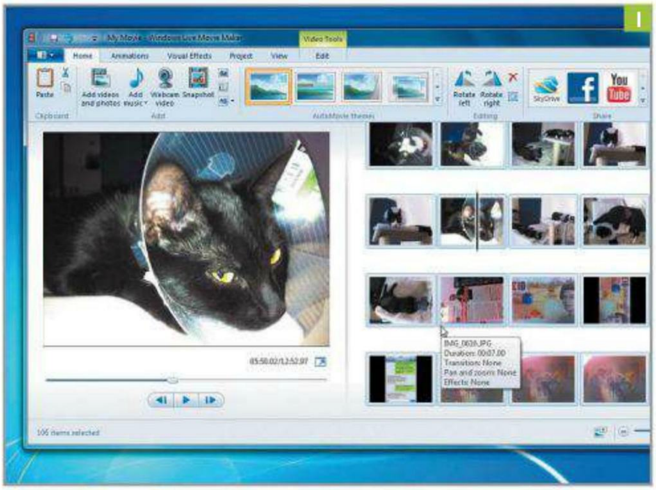
DREAMSCENE
Download the animated desktop tool from bit.ly/9nFLnB.

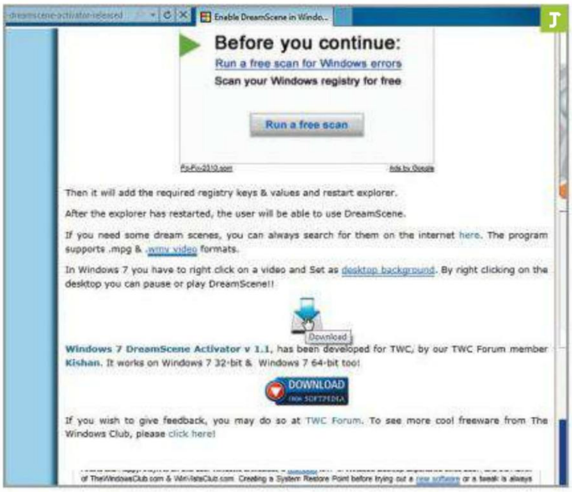
NOTHING WILL MAKE your computer look fresher than a great desktop background, but what if your background were a video? Back in the days of Windows Vista Ultimate, Microsoft developed Windows DreamScene, which let users liven up their everyday computing with animated wallpapers.

Microsoft removed the feature for Windows 7, but there are tools available that let you restore it. What's more—unlike in Windows Vista—you can add any MPEG or WMV video, not just those Microsoft has released, so your choices are limitless. We'll show you how to swap your lifeless wallpapers for moving masterpieces.

1 PREPARE YOURSELF Before we get into the nuts and bolts of installing DreamScene, you need to prepare your videos. If you don't have a video editor, you can download Windows Live Movie Maker **(image I)** free from bit.ly/ijzWm9. Keep your movie clips brief and remember that the program only supports MPEG and WMV videos.

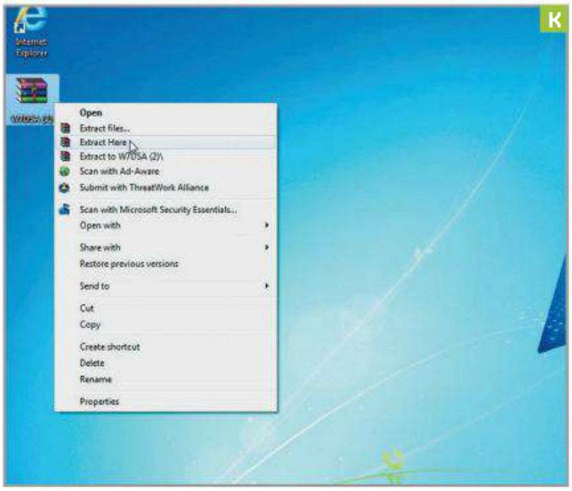
» You can find the DreamScene binary all over the Internet, but it's safest to download it from a reputable source. We recommend the Windows Club software repository at bit.ly/9nFLnB **(image J)**. The application comes in 32-bit and 64-bit flavors, but they are both bound in the same executable file, so just click and go.

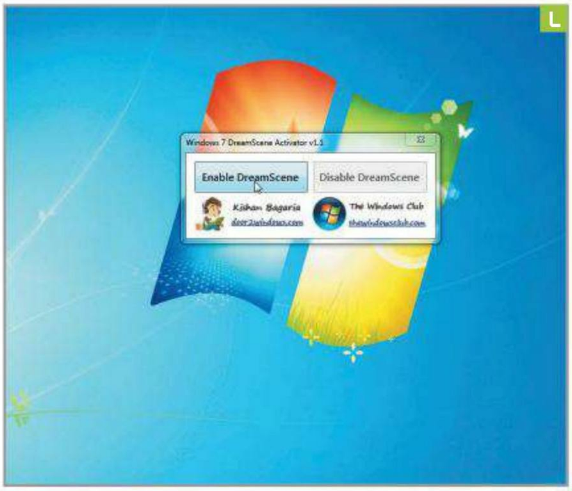




2 INSTALL DREAMSCENE When you've retrieved, extracted, and executed the all-important DreamScene file **(image K)**, you might receive an unhandled execution error message during installation. This is a known issue and nothing to worry about. If it happens, just click Continue and the process should continue as normal.

» To start using the DreamScene program, right-click the file called Windows 7 DreamScene Activator 1.1 and choose "Run as administrator." This is an essential step. A box will then appear with two simple options: Enable or Disable DreamScene **(image L)**. Click Enable and the relevant registry changes will be made to enable it on your machine.



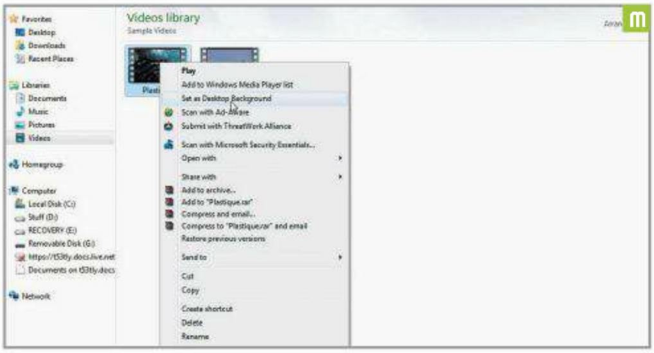


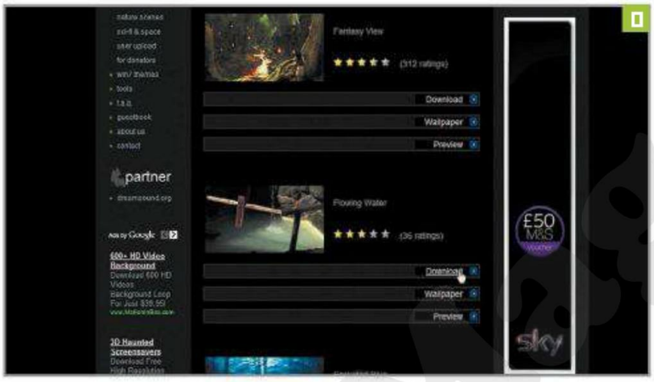
3 USE DREAMSCENE With the installation complete, you now need to find an MPEG or WMV video file to use. Windows 7 comes with a sample video, which you'll find in the Videos folder **(image M)**. (Click Start, choose your Documents folder, and then select Videos > Sample videos.) Right-click your chosen video and choose "Set as background."

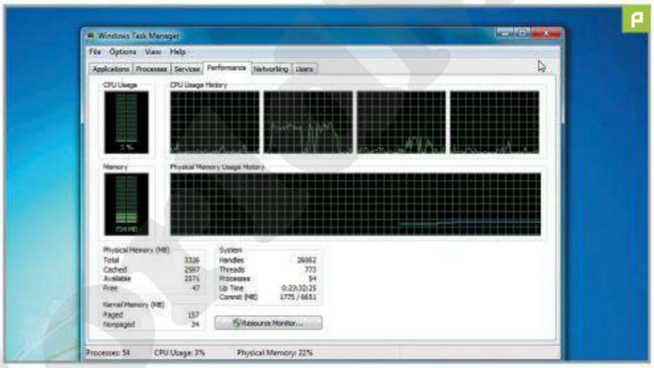
» Your new video file will now start playing on your desktop. The clip will run on an infinitely repeating loop. As good as this looks, it can be distracting and performance draining, so you'll want to turn it off again at times. To do this, just go back to a normal theme by right-clicking the desktop and choosing Personalize **(image N)**.

» While the animals in the sample videos folder are fun, their appeal is bound to run thin after a while. Luckily, you can find lots more DreamScene videos online. Visit www.dreamscene.org **(image O)** to find a wide selection of compatible and rather lovely looking videos that you can download and use as wallpaper.

» Performance-wise, DreamScene can be a resource hog, so it's a good idea to monitor how the program is using your system resources **(image P)**. It's also worth considering the impact an increased workload will have on mobile battery life. We recommend disabling the video desktop as a matter of course before you take your laptop on the road.







Mount a SkyDrive Virtual Drive

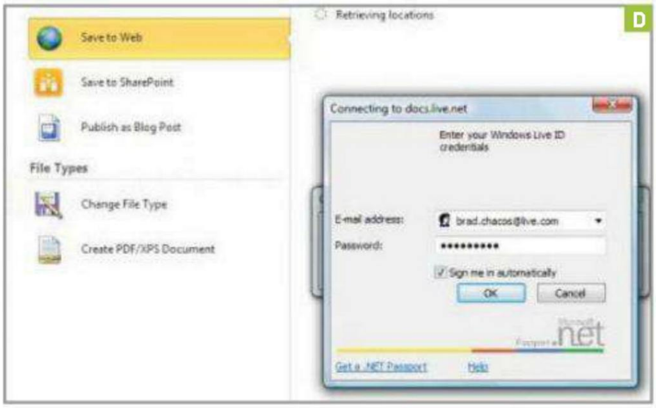
–Brad Chacos

ACCESSING YOUR DATA from virtually anywhere is easier than ever thanks to the rise of the cloud. Microsoft's SkyDrive provides a ridiculous 25GB of free storage, which is way more than the competitors, but accessing files using its web-based interface can be tedious, to put it nicely. We'll show you how to map your SkyDrive account as a network drive, which makes saving files to SkyDrive as simple as saving files to your C: drive. As a bonus, your Windows 7 PC won't be left out of the loop when Windows 8 and its built-in SkyDrive integration hit the streets later this year.

1 DISCOVERING YOUR SKYDRIVE'S URL

1 DISCOVERING YOUR SKYDRIVE'S URL You'll need a free Windows Live account and a copy of Microsoft Office 2010 to pull this off, so if you don't have those, go get them and then come back! (The trial version of Office works just fine if you don't feel like spending $100 for the full-blown suite.) Make sure to activate your SkyDrive by going to skydrive. live. com. Next, open an Office document, then select File > Save & Send > Save to Web > Sign In (to SkyDrive). Sign in with your Windows Live ID and password when prompted **(image D)**.

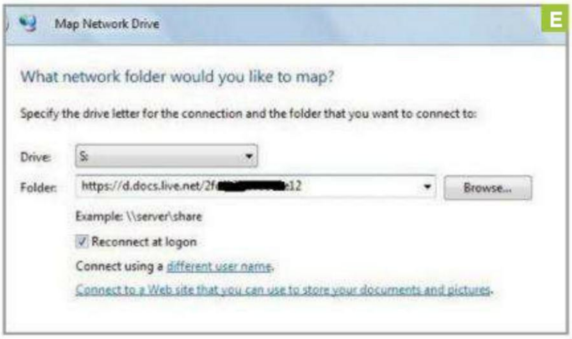
» You'll see a list of the folders in your SkyDrive. Pick any one, then click Save As. Don't be surprised if your PC freaks out and tosses up a "Not Responding" message here; just wait it out. Eventually a dialog box pops up. See the list of folders on the left side? Click the one that looks like a long string of letters and numbers—that's your main SkyDrive folder. A URL appears in the address bar at the top of the screen. Copy it, then close any open Microsoft Office documents.



2 MAPPING SKYDRIVE AS A NETWORK DRIVE

2 MAPPING SKYDRIVE AS A NETWORK DRIVE Now it's just a simple matter of mapping your SkyDrive the way you would any other network drive. Bring up the Start menu and right-click Computer, then select "Map network drive." Paste the SkyDrive URL into the Folder field, then choose a letter for the network drive. (We like "S," for SkyDrive.) Check the "Reconnect at login" box, then click "Connect using a different user name" and re-enter your Windows Live ID information. Click Finish to, well, finish **(image E)**.

» Your SkyDrive folder appears as a network drive, complete with its Documents, Music, Public, and Pictures subfolders.



3 LINKING YOUR WINDOWS LIVE ID WITH YOUR WINDOWS USER ACCOUNT

3 LINKING YOUR WINDOWS LIVE ID WITH YOUR WINDOWS USER ACCOUNT Theoretically, that's it, but in actuality you'll need to manually reconnect to Windows Live every time you reboot your computer. Linking your Windows Live ID with your Windows 7 user account bypasses that hassle.

» Crack open the Start menu one more time and find the User Accounts settings in the Control Panel. You'll see a "Link online IDs" option on the left side of the window **(image F)**. Just click that, and Windows will hold you by the hand the rest of the way. Be sure to sign in with the same Windows Live ID associated with the network-mapped SkyDrive account!

QUIRKS OF A NETWORK-MAPPED SKYDRIVE

Remember that although your SkyDrive appears to reside on your computer, it still lives in the cloud; as such, you'll need to download/upload files you want to open or save, which obviously requires an active Internet connection. Uploads are just as slow as they are using the web-based interface, and individual files have a 100MB cap. Also, the Properties option for mapped SkyDrives shows incorrect storage information, so you'll need to hop online and check out your remaining space allotment every now and then.

Benchmark Your Android Phone for Free –Seamus Bellamy

CAR NUTS RACE their rides to see whose machine is the fastest. Fitness fanatics run marathons to test their physical limitations and endurance against that of their fellows. Geeks and gearheads? Our battles are fought and won on the basis of how capable our hardware is. While our desktops and laptops might be a thing of wonder to behold, carrying them around with us for the sake of collecting the accolades we deserve isn't always convenient. Carrying around a smartphone or tablet, however, is.

Benchmarking quantifies your device's capabilities; it also provides the added benefit of telling you how well your phone manages the current version of your handset's operating system and apps, as well as whether future OS upgrades will slow all that zippy mobile computing hotness to a bag of sluggish hardware fail. If you're the owner of an Android handset, there are a lot of options out there for measuring its performance. Here are three of our favorite free benchmarking tools, and why we think you should use them.

1

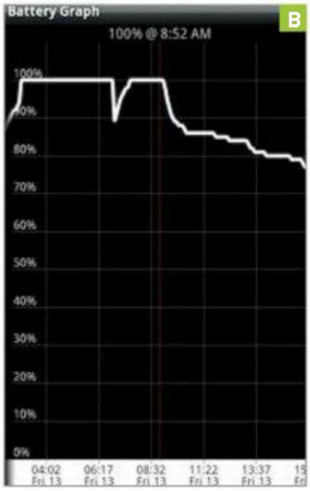
BENCHMARKPI BenchmarkPi (bit.ly/t7JJkP) gauges processor efficiency so well it'd make a grown man cry **(image A)**. The genius of BenchmarkPi is its simplicity: By measuring how quickly your handset is able to calculate Pi to a particular number of decimal places, BenchmarkPi can ascertain how powerful your processor is. Additionally, the app is great at being able to tell whether or not your device is burdened by other programs running in the background, making it easy to troubleshoot problem apps. If you're feeling competitive, you're in luck: BenchmarkPi also maintains a constantly updated list of the top 300 Android phones out there, ranking them by their processing power.

2

BATTERY GRAPH The harder your smartphone has to chug in order to crunch the numbers necessary to do important work (and by work we mean running a session of Minecraft Pocket Edition), the less juice your battery will have left for lower-priority tasks, such as calling your loved ones to assure them you're still alive and well despite the Creeper's best efforts.

» Battery Graph (bit.ly/see2TK) is designed to run in the background on your handset while you go about your business **(image B)**. Start it up when you turn on your phone, and check it out at the end of the day. While you're busy texting, finding your way with Google Maps, or having a jaw-wag with a co-worker via Skype, Battery Graph will quietly collect data on how each hoop you force your phone to jump through effects its power reserves. To snag a balanced benchmark of your battery's performance, drain its battery all the way down and then charge it completely before starting.

» In order to paint a true picture of your battery's performance, run Battery Graph over several days under normal operating conditions. Doing so will let you discover what applications and times of day take the biggest bite out of your battery's life, as well as show you how long your battery lasts during an average day.



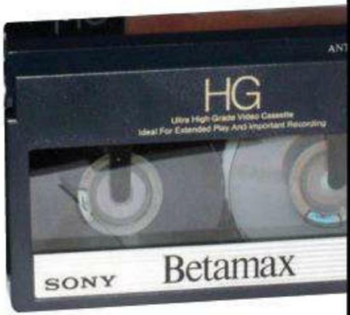
3

NENAMARK 1 & 2 Available in two different flavors—one for high-end Android phones and the other for handsets wielded by mere mortals—NenaMark (www.nena.se) is one of the easiest ways to benchmark your phone's GPU performance for free. By measuring the number of frames per second your smartphone can crank out in the face of parametric surfaces, varying light models, particles, and reflections **(image C)**, NenaMark is able to ascertain whether your phone takes graphical hits like a champ or a glass-jawed featherweight. Your handset's results can then be measured against those of other makes and models to see how your phone ranks.

THE LIST

8 FRUSTRATINGLY PROPRIETARY STORAGE FORMATS

8 BETAMAX



Thanks to the super kung-fu grip that Sony insisted on keeping on the format—and stiff competition from JVC's VHS format—Betamax was doomed to fail.

7 DIGITAL AUDIO TAPE (DAT)

This non-lossy recording medium capable of making an exact copy of any audio thrown at it proved a little too expensive to be widely adopted by consumers.

6 HD DVD

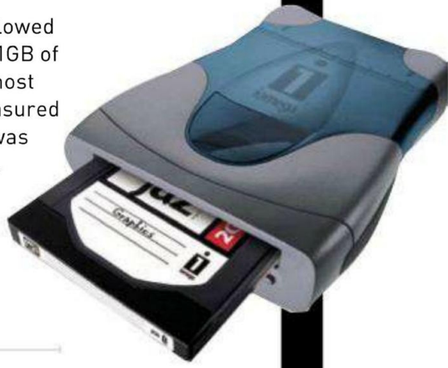
Early adopters who bet on HD DVD lost when Blu-ray proved to be *the* high-def optical disc standard.

5 ZIP

High-capacity floppy disks were good in theory. Unfortunately, the tech was expensive, required a proprietary drive, and were just as prone to failure as regular floppies.

4 JAZ

Iomega's Jaz disks allowed users to cart around 1GB of data at a time when most hard drives were measured in megabytes. But it was never widely adopted.



3 MEMORY STICK

Since being introduced by Sony in 1998, eight different versions of the Memory Stick have been brought to market, confusing and frustrating consumers. Enough already!

2 PS VITA MEMORY

When you buy a gaming console, you expect it to come ready to play games—unless it's a PlayStation Vita, whose proprietary memory cards are sold separately. Worst. Hidden. Cost. Ever.

1 XBOX HARD DRIVE

Microsoft designed the Xbox 360 to be used with a standard 2.5-inch SATA drive... equipped with a perplexing non-standard enclosure, connector, and firmware.

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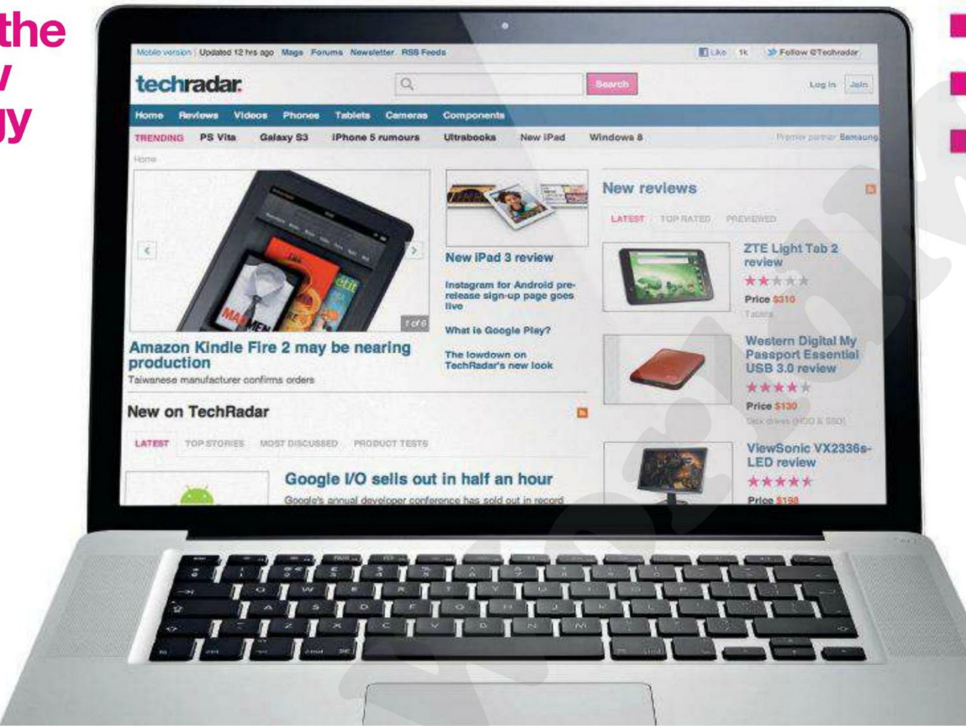

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